Mixed-Species Cetacean Groups

Bibliography

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Background & Scope

The persistence of mixed-species cetacean associations is an important facet of community ecology and could potentially aid conservation management. This annotated bibliography is arranged oldest-newest, by decades beginning in 1970, alphabetical by author within each year.

Sources Reviewed

The following databases were used to identify sources: Clarivate Analytics' Web of Science: Science Citation Index Expanded and Social Science Index; Science.gov; ProQuest's Science and Technology including Aquatic Science Fisheries Abstracts; Elsevier's Science Direct; JSTOR; EBSCO's Academic Search Complete and Environment Complete; NOAA's Institutional Repository; the Biodiversity Heritage Library; BioOne Complete; and Google Scholar.

1970s

Leatherwood, J. S. (1974). A Note on Gray Whale Behavioral Interactions with Other Marine Mammals. *Marine Fisheries Review, 36*(4), 50 Retrieved from https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/MFR/mfr364/mfr36414.pdf

[No abstract available]

1980s

Connor, R. C., & Norris, K. S. (1982). Are Dolphins Reciprocal Altruists? *The American Naturalist, 119*(3), 358-374 Retrieved from www.jstor.org/stable/2460934

We believe that when taken in its totality, the very scattered and often anecdotal literature on dolphins suggests the existence of a system based to a considerable degree on reciprocal altruism. The evidence of epimeletic behavior, though based wholly on anecdotes, is so common as to be overwhelming in its broad detail. The data on school structure, based on reliable marking studies at sea, clearly shows much fluidity of relationship, except in the larger dimorphic, polygynous species; but in both, intergeneric and interspecific cooperative behavior is clear. Reciprocal altruism carries with it the opportunity for the development of complicated social relationships involving, in addition to altruism, deceit, punishment of those who violate social rules, and complicated communication systems between school members. While we could cite isolated anecdotes supporting this or that development of these sorts, we prefer not to at this point, but instead to conclude that in dolphins we are surely dealing with complicated social systems whose outlines we are now just beginning to understand.

Polacheck, T. (1987). Relative Abundance, Distribution and Inter-Specific Relationship of Cetacean Schools in the Eastern Tropical Pacific. *Marine Mammal Science, 3*(1), 54-77 https://doi.org/10.1111/j.1748-7692.1987.tb00151.x

The relative abundance of the most common cetacean schools in the eastern tropical Pacific Ocean for 1977-1980 are estimated based on encounter rates with tuna purse-seiners. No temporal trends were apparent in the relative abundance estimates. The geographic distributions for eight different school types are described. Multivariate statistical techniques are used to investigate interrelations between species and relationships to parameters of the physical environment. The results suggest three major species groupings: (1) an inshore grouping of bottlenose dolphins (Tursiops truncatus), Risso's dolphin (Grampus griseus), pilot whales (Globicephala macrorhynchus) and, to a lesser extent, common dolphins (Delphinus delphis); (2) an offshore pelagic grouping of spotted and spinner dolphins (Stenella attenuata and S. longirostris); and (3) an association between pilot whales and common dolphins that overlaps the first grouping in inshore areas and also tends to be segregated from the second grouping. The results also suggest that relative densities of different school types ate strongly related to physical environmental parameters, the most important being sea surface temperature, depth of the thermocline and thickness of the oxygen minimum layer.

1990s

Jefferson, T. A., Stacey, P. J., & Baird, R. W. (1991). A Review of Killer Whale Interactions with Other Marine Mammals: Predation to Co-Existence. *Mammal Review, 21*(4), 151-180 https://doi.org/10.1111/j.1365-2907.1991.tb00291.x

Killer Whales are well-known as predators of other marine mammals, including the large Sperm and baleen whales. Members of all marine mammal families, except the river dolphins and manatees, have been recorded as prey of Killer Whales; attacks have been observed on 20 species of cetaceans, 14 species of pinnipeds, the Sea Otter, and the Dugong. Ecological interactions have not been systematically studied and further work may indicate that the Killer Whale is a more important predator for some populations than previously believed. Not all behavioural interactions between Killer Whales and other marine mammal species result in predation, however. Some involve 'harassment' by the Killer Whales, feeding by both species in the same area, porpoises playing around Killer Whales, both species apparently 'ignoring' each other, and even apparently unprovoked attacks on Killer Whales by sea lions. These non-predatory interactions are relatively common. We conclude that interactions between Killer Whales and marine mammals are complex, involving many different factors that we are just beginning to understand.

Mangels, K. F., & Gerrodette, T. (1994). Report on Cetacean Sightings During a Marine Mammal Survey in the Eastern Tropical Pacific Aboard the NOAA Ships McArthur and David Starr Jordan, July 28-November 2, 1992. Retrieved from https://repository.library.noaa.gov/view/noaa/6173

[No abstract available]

Shane, S. H. (1995). Relationship between Pilot Whales and Risso's Dolphins at Santa Catalina Island, California, USA. *Marine Ecology Progress Series, 123*, 5-11 Retrieved from https://www.jstor.org/stable/24853163

Abundance of pilot whales at Santa Catalina Island, California, USA, declined from several hundred to between 0 and 33 per winter following the 1982-83 El Nixio-Southern Oscillation. Starting in 1987, abundance of Risso's dolphins, rarely seen before that time, increased. During a 9-winter-long study at Santa Catalina Island, parallels between the behavior and distribution of these 2 medium-sized, squid-eating delphinids were documented. One possibly aggressive encounter between pilot whales and Risso's dolphins was observed and others were reported. These factors led to the hypothesis that, while the ranges of these 2 species overlap, competitive displacement will generally prevent co-occurrence of these species in restricted geographic areas with limited food resources such as seen at Santa Catalina Island.

Shelden, K. E., Baldridge, A., & Withrow, D. E. (1995). Observations of Risso Dolphins, Grampus Griseus with Gray Whales, Eschrichtius Robustus. *Marine Mammal Science, 11*(2), 231-240 https://doi.org/10.1111/j.1748-7692.1995.tb00521.x

[No abstract available]

Bearzi, G. (1996). A 'Remnant'common Dolphin Observed in Association with Bottlenose Dolphins in the Kvarneric (Northern Adriatic Sea). *European Research on Cetaceans, 10*, 204 Retrieved from https://www.europeancetaceansociety.eu/previous-conferences

In the course of a longterm study focusing on bottlenose dolphin social ecology and behaviour, conducted since 1987 in the Kvameric (Northern Adriatic Sea), common dolphins - the only other cetacean species observed in the region, were encountered only three times. The same individual common dolphin was photo-identified on all three occasions: the first time (August 1991) with three other conspecifics, and the other two times (August 1994 and July 1995) together with bottlenose dolphins.

Gotelli, N. J., & Graves, G. R. (1996). *Null Models in Ecology*. Washington: Smithsonian Institution Press. Retrieved from http://www.uvm.edu/~ngotelli/nullmodelspage.html

[No abstract available]

Ross, H. M., & Wilson, B. (1996). Violent Interactions between Bottlenose Dolphins and Harbour Porpoises. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 263*(1368), 283-286 https://doi.org/10.1098/rspb.1996.0043

The majority (63 %) of harbour porpoises stranded around the Moray Firth, Scotland, died from trauma characterized by multiple skeletal fractures and damaged internal organs. Surface injuries consisted of skin cuts resembling the teeth marks inflicted by one cetacean on another. The spacings between these matched those between teeth in bottlenose dolphins, of which there is a population in the Moray Firth. Four violent dolphin—porpoise interactions have been witnessed. Reasons for these interactions are unknown and similar documented examples between other mammals are extremely rare. These findings challenge the benign image of bottlenose dolphins and provide a hitherto unrecorded cause of mortality in porpoises.

Weller, D. W., Würsig, B., Whitehead, H., Norris, J. C., Lynn, S. K., Davis, R. W., . . . Brown, P. (1996). Observations of an Interaction between Sperm Whales and Short-Finned Pilot Whales in the Gulf of Mexico. *Marine Mammal Science, 12*(4), 588-594 https://doi.org/10.1111/j.1748-7692.1996.tb00071.x

[No abstract available]

Herzing, D. L., & Johnson, C. M. (1997). Interspecific Interactions between Atlantic Spotted Dolphins (Stenella Frontalis) and Bottlenose Dolphins (Tursiops Truncatus) in the Bahamas, 1985–1995. *Aquatic Mammals, 23*(2), 85-99 Retrieved from https://www.aquaticmammalsjournal.org/share/AquaticMammalsIssueArchives/1997/AquaticMammals_23-02/23-02_Herzing.pdf

Free-ranging Atlantic spotted dolphins, Stenella frontalis, and bottlenose dolphins, Tursiops truncatus, were observed in Bahamian waters from 1985–1995. Interspecific interactions between these two

species were documented and are reported here. Of 1246 encounters with dolphins, over 15% were mixed species activity. Of these encounters, 60% were affiliative 34.9% were aggressive, and 4.8% involved foraging activity. Compared to single species, mixed species encounters were (1) longer in duration and (2) larger in group size. Mixed species encounters that were affiliative in nature were significantly shorter in duration and smaller in group size than aggressive encounters. The ratio of spotted dolphins to bottlenose dolphins was significantly less during foraging activity than it was in other behaviors. Mating, with penile intromission, was seen between adult male bottlenose dolphins and juvenile spotted dolphins of both sexes. Young adult males of both species engage in interspecific high-energy bouts of sexual play and aggression. The antagonists in these encounters were often conspecific coalitions of spotted dolphins and solitary or small groups of bottlenose dolphins. Mixed-sex, mixedspecies adult groups (including pregnant females) were seen foraging together and traveling together. Interspecific coalitions of males were observed during interspecific and interindividual (intraspecific) conflicts. Alloparental behavior, between a young adult female spotted dolphin and an emaciated bottlenose dolphin calf was also observed. The costs and benefits of interspecific associations—including predator protection, competitive and cooperative foraging strategies, shared repertoire of vocal and gestural signals, and the question of species divisions and hybridization are discussed.

Ballance, L. T., & Pitman, R. L. (1998). Cetaceans of the Western Tropical Indian Ocean: Distribution, Relative Abundance, and Comparisons with Cetacean Communities of Two Other Tropical Ecosystems. *Marine Mammal Science, 14*(3), 429-459 https://doi.org/10.1111/j.1748-7692.1998.tb00736.x

We conducted a cetacean survey in the pelagic western tropical Indian Ocean (WTIO) aboard an 85-m research vessel from March to July 1995, covering 9,784 linear km. Using 25x binoculars and line-transect methods, we recorded 589 sightings of 21 species. Stenella longirostris was the most abundant cetacean, in terms of number of individuals sighted, by an order of magnitude above any other species, while Physeter macrocephalus was the most frequently sighted, in terms of number of schools. Twelve species were widespread, seven were rare, and two were localized; our sightings include new distributional records for 12 species. Significant observations included the following: (1) Delphinus cf. tropicalis was abundant off the coast of Oman (16 sightings) and readily distinguishable in the field from D. delphis and D. capensis, (2) Balaenoptera musculus was fairly common and localized in the area of the Maldives (17 sightings), and (3) three sightings were made of an unidentified bottlenose whale tentatively referred to as Indopacetus (i.e., Mesoplodon) pacificus. We recorded 26 mixed-species cetacean schools, 43 schools with which seabirds associated, and 17 schools associated with tuna. Notable among these were mixed aggregations of Stenella attenuata, S. longirostris, yellowfin tuna, and seabirds. The cetacean community of the WTIO was similar to that of the eastern tropical Pacific (ETP) and the Gulf of Mexico (GM) in several respects. First, differences in abundance rank of individual species were small, with the result that common species were common and rare species were rare, regardless of ocean. Second, these differences in abundance were due primarily to differences in encounter rate, which varied with ocean by as much as 3,000%, and less so to school size, which generally varied less than 100%. Third, regardless of ocean, three species comprised the majority of cetaceans in the community, Stenella attenuata, S, longirostris, and S. coeruleoalba, representing 62%-82% of all individuals for all species. However, the rank order of abundance for these three species differed with ocean. Most notably, S. attenuata was abundant in the ETP and GM (abundance rank = 2 and 1, respectively) but much less common in the WTIO (abundance rank = 6). Although habitat preferences for S. attenuata appear to overlap considerably with those of S. longirostris in the ETP, our

results suggest there may actually be significant differences between these two species. Detailed analysis of oceanographic correlates of distribution will be necessary in order to understand fully the habitat requirements of these pelagic dolphins, often the most conspicuous elements of tropical cetacean communities around the world.

Baraff, L. S., & Asmutis-Silvia, R. A. (1998). Long-Term Association of an Individual Long-Finned Pilot Whale and Atlantic White-Sided Dolphins. *Marine Mammal Science, 14*(1), 155-161 https://doi.org/10.1111/j.1748-7692.1998.tb00700.x

Multispecies associations range from congeneric to interordinal and occur across a wide range of taxa. They have been described for numerous mammalian species, including cetaceans (references below). The nature of these associations is not always clear, and they may be of temporal or spatial happenstance without direct interaction, or more dynamic with direct interactions and coordinated activities. Although they typically involve groups of individuals from the associating species, occasionally a single animal will join a group of heterospecifics. Most multispecies associations appear to be relatively brief, and associations across years are quite rare. Bearzi (in press) reported seeing the same common dolphin (DeIpbinus delphis) with bottlenose dolphins (Tursiops truncatus) in two different years, and M. Poole (personal communication) has observed an individual spinner dolphin (Stenella longirostrzs) with bottlenose dolphins over four years. There are no other documented accounts of relationships of such duration. The association described here, of an individually identified long-finned pilot whale (Globicepbala melas) with Atlantic white-sided dolphins (Lagenorbyncbus acutus) over six consecutive years is thus highly unusual.

Orr, J. R., & Harwood, L. A. (1998). Possible Aggressive Behavior between a Narwhal (Monodon Monoceros) and a Beluga (Delphinapterus Leucas). *Marine Mammal Science, 14*(1), 182-185 https://doi.org/10.1111/j.1748-7692.1998.tb00705.x

On 2 October 1991 two Inuvialuit hunters from Tuktoyaktuk, Northwest Territories (NT), were hunting seals in Kugmallit Bay, at a location approximately 6-7 km northwest of their community (Fig. 1). The men sighted a group of four large white belugas (Delphinapterus leucas), one of which they shot and towed back to their community for processing and consumption.

2000s

Ciano, J., & Jøorgensen, R. (2000). Observations on an Interaction between a Humpback Whale (Megaptera novaeangliae) and Pilot Whales (Globicephala melas). *Marine Mammal Science, 16*(1), 245-248 https://doi.org/10.1111/j.1748-7692.2000.tb00916.x

[No abstract available]

Garcia, S., Knouse, D., Sagarminaga, R., & Cañadas, A. (2000). An Insight on the Biological Significance of Mixed Groups of Common Dolphins (Delphinus delphis) and Striped Dolphins (Stenella coeruleoalba) in the Alboran Sea. *European Research on Cetaceans, 14*, 135-137 Retrieved from https://www.europeancetaceansociety.eu/previous-conferences

The Alboran Sea appears to be an ideal research site for studying the magnitude and possible causes of the apparent decline of the common dolphin (Delphinus delphis) population in the Mediterranean. One of the hypotheses that has been suggested by several authors is that of the existence of competition between this species and striped dolphins (Stenella coeruleoalba) (Viale, 1980; Casinos, 1982). The striped and common dolphins are at present the most frequently encountered species in the Alboran Sea region. The first species is now considered very abundant throughout the pelagic waters of the Mediterranean, whereas the latter is nowadays only seldom observed north of latitude 37" 40' N, which is the northern limit of the research area (Gannier, 1995; Forcada and Hammond, 1998; Cañadas et al,1999). The aim of this study was to test the hypothesis of a possible competition between the two species by analysing the inter-specific relations between them.

Heckel, G., Murphy, K. E., & Jimenez, G. A. C. (2000). Evasive Behavior of Spotted and Spinner Dolphins (Stenella attenuata and S. longirostris) During Fishing for Yellowfin Tuna (Thunnus albacares) in the Eastern Pacific Ocean. *Fishery Bulletin, 98*, 692-703 Retrieved from https://spo.nmfs.noaa.gov/sites/default/files/04.pdf

This study examines the question of whether the evasive behavior of northeastern offshore spotted dolphins (Stenella attenuata) during fishing for tuna (by the Mexican fleet) varies in geographic areas of the eastern Pacific Ocean (EPO). It also investigates whether evasion differs between northeastern offshore spotted and eastern spinner dolphins (Stenella longirostris orientalis). Observations recorded in the database of the Mexican Programa Nacional de Aprovechamiento del Atún y de Protección de Delfi nes (PNAAPD) from 1992 to 1995 were analyzed. The calculated evasion index was the estimated percentage of dolphins that evaded capture in relation to the herd's estimated initial size in each set. Evasion index by set was averaged in 2 × 2 quadrants and then used to draw a contour map. Three areas were outlined with low (25%), medium (44.44%), and high (71.80%) median evasion indices. These areas were signifi cantly different ($P<0.0001$) according to the Kruskal-Wallis nonparametric multisample test, thus indicating a spatial pattern in evasive behavior of northeastern offshore spotted dolphins during fishing operations of the Mexican fleet. Spatial patterns in evasive behavior might be related to the dolphins' learning capacity, hence experience of individual dolphins or herds with tuna purse-seining in the EPO should be estimated to demonstrate this. To be representative, future research should utilize available historical fi shing effort data for the international fleet. Furthermore, a multivariate approach to this issue is necessary. One of the investigated areas (mouth of the Gulf of California) was further analyzed regarding differences between two stocks of dolphins. Evasion indices for eastern spinners were significantly different from those for northeastern offshore spotted dolphins ($P<0.0001$, Kolmogorov-Smirnov two-sample test). This difference may correspond to different evasive strategies used by the two stocks to evade capture in the net, such as evasion under the net and dispersion (division of herd into subgroups during the set). Eastern spinners apparently evaded more frequently than northeastern offshore spotted dolphins by diving under the net. During the three set stages of tuna fishing (before chase, during chase, and during encirclement), eastern spinner dolphins dispersed less often than spotted dolphins, behavior that may permit them to coordinate their evasive movements more effectively than northeastern offshore spotted dolphins. Evasion over the net was rarely observed in either stock.

Baumgartner, M. F., Mullin, K. D., May, L. N., & Leming, T. D. (2001). Cetacean Habitats in the Northern Gulf of Mexico. *Fishery Bulletin, 99*(2), 219-219 Retrieved from https://www.whoi.edu/cms/files/fb99219_59386.pdf

Surveys were conducted in the northern Gulf of Mexico during the spring seasons of 1992, 1993, and 1994 to determine the distribution, abundance, and habitat preferences of oceanic cetaceans. The distributions of bottlenose dolphins (Tursiops truncatus), Risso's dolphins (Grampus griseus), Kogia spp. (pygmy [Kogia breviceps] and dwarf sperm whales [Kogia sima]), pantropical spotted dolphins (Stenella attenuata), and sperm whales (Physeter macrocephalus) were examined with respect to depth, depth gradient, surface temperature, surface temperature variability, the depth of the 15°C isotherm, surface chlorophyll concentration, and epipelagic zooplankton biomass. Bottlenose dolphins were encountered in two distinct regions: the shallow continental shelf (0–150 m) and just seaward of the shelf break (200–750 m). Within both of these depth strata, bottlenose dolphins were sighted more frequently than expected in regions of high surface temperature variability which suggests an association with ocean fronts. Risso's dolphins were encountered over the steeper sections of the upper continental slope (200–1000 m), whereas the Kogia spp. were sighted more frequently in waters of the upper continental slope that had high zooplankton biomass. The pantropical spotted dolphin and sperm whale were similarly distributed over the lower continental slope and deep Gulf (>1000 m), but sperm whales were generally absent from anticyclonic oceanographic features (e.g. the Loop Current, warm-core eddies) characterized by deep occurrences of the 15°C isotherm. Habitat partitioning, high-use areas, species accounts, environmental sampling limitations, and directions for future habitat work in the Gulf of Mexico are discussed.

Clua, É., & Grosvalet, F. (2001). Mixed-Species Feeding Aggregation of Dolphins, Large Tunas and Seabirds in the Azores. *Aquatic Living Resources, 14*(1), 11-18 https://doi.org/10.1016/S0990-7440(00)01097-4

Each summer the presence of large concentrations of bait fish in the area of the central Azores Islands gives rise to mixed-species feeding aggregations usually at dawn and dusk. The encircling of prey initiated by common dolphins (Delphinus delphis), often mixed with spotted dolphins (Stenella frontalis), results in the formation of a compact 'ball' of several thousands prey fish close to the surface. Other dolphins, in particular the bottlenose (Tursiops truncatus), also eat the prey fish, whose high concentration makes them easy to capture. Large tunas (Thunnus thynnus, Thunnus albacares) sometimes participate in the phenomenon. Seabirds (mainly cory's sheawaters, Calonectris diomedea borealis) are always present throughout the few minutes during which the entire collective food hunt takes place. A model of the phenomenon, based on 15 observations, is proposed. It comprises 4 stages: a preparation phase, an intensification phase, a mature phase, and a dispersion phase. These observations allow a better understanding of the tuna-dolphin aggregation process. They show that it is the tunas that generate and beneficiate from the aggregation with dolphins, rather than the contrary.

Frantzis, A., & Herzing, D. L. (2002). Mixed-Species Associations of Striped Dolphins (Stenella coeruleoalba), Short-Beaked Common Dolphins (Delphinus delphis), and Risso's Dolphins (Grampus griseus) in the Gulf of Corinth (Greece, Mediterranean Sea). *Aquatic Mammals, 28*(2), 188-197 Retrieved from https://www.aquaticmammalsjournal.org/share/AquaticMammalsIssueArchives/2002/AquaticMammals_28-02/28-02_Frantzis.pdf

Surveys to assess cetacean presence were conducted in July 1995 and 1997 in the Gulf of Corinth, which is an almost-enclosed sea in Greece, Eastern Mediterranean. The dolphin sighting frequencies were high (0.043 sightings/km). Four dolphin species were encountered: striped dolphins (Stenella coeruleoalba), short-beaked common dolphins (Delphinus delphis), Risso's dolphins (Grampus griseus) and bottlenose dolphins (Tursiops truncatus). Bottlenose dolphins were encountered only once. Thirteen dolphin sightings were single-species, (striped dolphins) and seven were mixed-species with either two species (striped and common dolphins in five sightings), or three species (striped, common, and Risso's dolphins in two sightings) in the group. In all mixed-species sightings, Risso's dolphins and common dolphins were always, and by far the minority species, present. To date, no single-species groups of Risso's or short-beaked common dolphins have been observed in the Gulf of Corinth. Interspecific rake marks on the Risso's dolphins, and behaviours observed through video analysis, indicated potentially complex and regular interspecific interactions. Our results support the idea that interspecific interactions between sympatric cetacean species in the area are common and apparently complex.

Mussi, B., Miragliuolo, A., & Bearzi, G. (2002). Short-Beaked Common Dolphins around the Island of Ischia, Italy (Southern Tyrrhenian Sea). *Proceedings of the Sixteenth Annual Conference of the European Cetacean Society, Liège, Belgium* Retrieved from https://www.europeancetaceansociety.eu/previous-conferences

The short-beaked common dolphin (Delphinus delphis) - once one of the commonest cetacean species in the Mediterranean Sea - has faced a dramatic decrease in the last few decades. Between July-September 1997-2001, relatively large groups (mean group size = 65.48 SD=23.94, N=41, range 35-100) were consistently encountered off the island of Ischia, Italy. Observations, totalling 79 h 45 min, were carried out from a 18 m sailing vessel. Most of the survey effort was concentrated north of the island, within 11 km from the coast, during 256 daily surveys covering nearly 8,500 km. The animals were always sighted over the submarine canyon of Cuma, a highly productive marine area characterised by high pelagic biodiversity and multi-species associations. The area represents an important feeding site for other cetacean species, including Stenella coeruleoalba, Grampus griseus and Balaenoptera physalus. A total of 46 individuals could be opportunistically photo-identified based on natural marks on their dorsal fins. Of these, 19 individuals were re-sighted in different years, suggesting high levels of site fidelity. Breeding activities were often observed, and a high percentage of calves were always present in one or more of the group sub-units. Surface feeding was recorded frequently, and apparently focused on the skipper (Scomberesox saurus), a seasonal fish that is highly valued on local markets. Local fishermen claim that co-operative fishing may occur in the area, with fishermen taking advantage of fish aggregations that are actively schooled by short-beaked common dolphins near the surface. In the past, fish rewards were offered to the dolphins in reciprocation. Based on interviews conducted locally, the skipper fishery fleet has decreased by one order of magnitude due to declined fish stocks. The creation of a marine protected area has been proposed, which might provide research and conservation benefits in the future.

O'Callaghan, T. M., & Baker, C. S. (2002). *Summer Cetacean Community, with Particular Reference to Bryde's Whales, in the Hauraki Gulf, New Zealand* (Vol. 55): Department of Conservation. Retrieved from https://core.ac.uk/download/pdf/21723898.pdf

A pilot study was undertaken from 13 November 2000 to 16 February 2001 to investigate the distribution, behaviour, and individual identification of Bryde's whales (Balaenoptera edeni) in the Hauraki Gulf, New Zealand. Cetaceans were observed from a commercial marine mammal tour vessel on 125 survey trips over a 47-day sampling period. In addition, sightings of cetaceans were recorded by the vessel's crew from 7 October 2000 to 16 February 2001, during 167 trips over 118 days. On 144 trips where cetaceans were sighted, we recorded six cetacean species. Bryde's whales were encountered 29 times, often seen feeding (90.9% of encounters) singly or in small, loose aggregations. Eighteen Bryde's whales were individually identified from photographs of the dorsal fin. Common dolphins (Delphinus delphis) were by far the most common cetacean in terms of animal number and sighting frequency, with 91.7% of all encounters including this species. Common dolphin schools of 150 animals were not uncommon, with larger congregations recorded on occasion. Other species recorded include bottlenose dolphins (Tursiops truncatus), long-finned pilot whales (Globicephala melas), killer whales (Orcinus orca) and Arnoux's beaked whales (Berardius arnouxii). We recorded 25 schools of mixed species, predominantly Bryde's whales and common dolphin associations.

Herzing, D. L., Moewe, K., & Brunnick, B. J. (2003). Interspecies Interactions between Atlantic Spotted Dolphins, Srenella firontalis and Bottlenose Dolphins, Tursiops Truncatus, on Great Bahama Bank, Bahamas. *Aquatic Mammals, 29*(3), 335-334I Retrieved from https://www.aquaticmammalsjournal.org/index.php?option=com_content&view=article&id=236:interspecies-interactions-between-atlantic-spotted-dolphins-stenella-frontalis-and-bottlenose-dolphins-tursiops-truncatus-on-great-bahama-bank-bahamas&catid=10&Itemid=157

Atlantic spotted dolphins (Stenella frontalis) and bottlenose dolphins (Tursiops truncatus) inhabit the western edge of Great Bahama Bank (GBB), Bahamas. In 1998, a photo-identification and behaviour project was initiated in this area. Over three consecutive winters (64 days) dolphins were observed on GBB. Interspecific behaviours are described over 6 years (1998 & 2003). Habitat of GBB is comparable to an adjacent study site on Little Bahama Bank (LBB) that has been under observation since 1985. To date, no photoidentification overlap has been documented between the two study sites (62 identified spotted dolphins on GBB and 220 identified spotted dolphins on LBB). Size of single species groups (GBB=9.1±SD 6.8/LBB=9.3±SD 8.0) and average duration of encounters (GBB=28 min/LBB=31 min) were similar. Mothers with calves on GBB were mottled in coloration, similar to first parturition coloration reported for LBB spotted dolphins. The majority of behavioural activities documented for LBB spotted dolphins during summer months were observed on GBB during winter months, including foraging in the sand, travelling, resting, playing, disciplining, courtship/mating, and intra and interspecific aggression with bottlenose dolphins. In addition, in 2002 male spotted dolphins were observed in dominant mounting behaviour of male bottlenose dolphins (reverse roles to LBB). In the winter of 2003, a hybrid male calf was repeatedly observed with a lactating adult female spotted dolphin. The offshore form of the bottlenose dolphin was observed on GBB, engaging in aggressive activity with resident spotted dolphins. Ongoing research in these adjacent study sites includes genetic sampling and habitat analysis to provide insight into the comparative natures of these two adjacent sandbanks and delphinid species.

Lusseau, D. (2003). The Emergent Properties of a Dolphin Social Network. *Proceedings: Biological Sciences, 270*(1530 Supplement 2), 186-188 https://doi.org/10.1098/rsbl.2003.0057

Many complex networks, including human societies, the Internet, the World Wide Web and power grids, have surprising properties that allow vertices (individuals, nodes, Web pages, etc.) to be in close contact

and information to be transferred quickly between them. Nothing is known of the emerging properties of animal societies, but it would be expected that similar trends would emerge from the topology of animal social networks. Despite its small size (64 individuals), the Doubtful Sound community of bottlenose dolphins has the same characteristics. The connectivity of individuals follows a complex distribution that has a scale-free power-law distribution for large k. In addition, the ability for two individuals to be in contact is unaffected by the random removal of individuals. The removal of individuals with many links to others does affect the length of the 'information' path between two individuals, but, unlike other scale-free networks, it does not fragment the cohesion of the social network. These self-organizing phenomena allow the network to remain united, even in the case of catastrophic death events.

Psarakos, S., Herzing, D. L., & Marten, K. (2003). Mixed-Species Associations between Pantropical Spotted Dolphins (Stenella attenuata) and Hawaiian Spinner Dolphins (Stenella longitrostris) Off Oahu, Hawaii. *Aquatic Mammals, 29*(3), 390-395 Retrieved from https://www.aquaticmammalsjournal.org/index.php?option=com_content&view=article&id=229:mixed-species-associations-between-pantropical-spotted-dolphins-stenella-attenuata-and-hawaiian-spinner-dolphins-stenella-longirostris-off-oahu-hawaii&Itemid=157

Mixed-species interactions were observed between Pantropical spotted dolphins, Stenella attenuata, and spinner dolphins, Stenella longirostris,in Hawaiian waters between 1996 and 1998. Year round observations were made of spinner dolphins entering a shallow bay off the Waianae (Western) coast of Oahu. Mixed-species observations occurred on 19 days between 1996–1998. Spinner dolphins were typically present in greater numbers than spotted dolphins with ratios as high as 75:1. Interspecific behaviours observed include aggression, copulation, and travelling. Five aggressive interactions are described in detail. These behavioural observations are similar to those observed between other delphinid species around the world and suggest that sympatric delphinid species may be more common than previously reported and may have common communication and social signals.

Stensland, E. V. A., AngerbjöRn, A., & Berggren, P. E. R. (2003). Mixed Species Groups in Mammals. *Mammal Review, 33*(3-4), 205-223 https://doi.org/10.1046/j.1365-2907.2003.00022.x

1. Mixed species groups have long been noted in birds, but they also occur among different species of mammals ranging from closely related species to species from different orders. Mixed species groups of mammals occur in many different habitats, e.g. ungulates on the savannah, primates in various types of forests and cetaceans in the oceans. Mixed species groups are very different in their duration, frequency, predominant activity and structure depending on the species interacting and the habitat they occur in.
2. Functional explanations for mixed species groups usually fall within two categories: foraging advantages and predator avoidance. However, there could also be other social and reproductive advantages of mixed species groups that could contribute to their formation and stability. The advantages do not have to be equally distributed between the participating species and can also vary according to season and the presence of predators.
3. It is important that all investigators of mixed species groups take their studies one step further after the naturalistic description and test the function and benefits of mixed species groups in order to give more strength to their conclusions. In this paper we review and discuss the function of mixed species groups in mammals and suggest an approach on how to investigate the function of such groups.

David, L., & Newman, M. E. J. (2004). Identifying the Role That Animals Play in Their Social Networks. *Proceedings of the Royal Society B: Biological Sciences, 271*(6), S477-S481 https://doi.org/10.1098/rsbl.2004.0225

Techniques recently developed for the analysis of human social networks are applied to the social network of bottlenose dolphins living in Doubtful Sound, New Zealand. We identify communities and subcommunities within the dolphin population and present evidence that sex- and age-related homophily play a role in the formation of clusters of preferred companionship. We also identify brokers who act as links between sub-communities and who appear to be crucial to the social cohesion of the population as a whole. The network is found to be similar to human social networks in some respects but different in some others, such as the level of assortative mixing by degree within the population. This difference elucidates some of the means by which the network forms and evolves.

Jackson, A. R., Gerrodette, T., Chivers, S. J., Lynn, M. S., Olson, P. A., & Rankin, S. (2004). *Marine Mammal Data Collected During a Survey in the Eastern Tropical Pacific Ocean Aboard the NOAA Ships McArthur II and David Starr Jordan, July 29 - December 10, 2003*. (NOAA-TM-NMFS-SWFSC-366). La Jolla, CA: Southwest Fisheries Science Center, Retrieved from https://repository.library.noaa.gov/view/noaa/3701

"The primary objective of the study was to estimate abundances of the dolphin stocks affected by the ETP purse-seine fishery for yellowfin tuna (Thunnus albacares). The survey's design targeted the depleted stocks of eastern spinner dolphins (Stenella longirostris orientalis) and the northeastern offshore stock of spotted dolphins (Stenella attenuata). In addition to data suitable for line-transect analysis, behavioral, acoustic, photogrammetric, genetic, morphological, and individual whale identification data were collected on the region's cetaceans and are described in this report"--Survey objectives (page 2).

Wedekin, L. L., Daura-Jorge, F. G., & Simões-Lopes, P. C. (2004). An Aggressive Interaction between Bottlenose Dolphins (Tursiops truncatus) and Estuarine Dolphins (Sotalia guianensis) in Southern Brazil. *Aquatic Mammals, 30*(3), 391-397 https://doi.org/10.1578/AM.30.3.2004.391

For the first time we report on an aggressive interaction between wild bottlenose dolphins (Tursiops truncatus) and estuarine dolphins (Sotalia guianensis) observed in Baía Norte, southern Brazil. Three bottlenose dolphins aggressively herded a Sotalia guianensis calf, which was the main target of the aggressive and threatening behaviours of the bottlenose dolphins. Another two to four adult S. guianensis were involved in the interaction and were constantly chased by the bottlenose dolphins. After approximately two hours, the bottlenose dolphins left the calf and the area, and no dead or wounded animals were seen afterwards. We provide a detailed spatial and temporal description of the interaction, and discuss the potential causes of this event.

Wedekin, L. L., Freitas, A., Engel, M. H., & Sazima, I. (2004). Rough-Toothed Dolphins (Steno bredanensis) Catch Diskfishes While Interacting with Humpback Whales (Megaptera

novaeangliae) Off Abrolhos Bank Breeding Ground, Southwest Atlantic. *Aquatic Mammals, 30*(2), 327-329 https://doi.org/10.1578/AM.30.2.2004.327

We provide a summary of interactions between humpback whales (Megaptera novaeangliae) and rough-toothed dolphins (Steno bredanensis) observed during a long-term study conducted at the Abrolhos Bank off Brazil, with additional notes on the behaviour of both cetacean species. One dolphin caught and likely preyed on a diskfish (Echeneidae) while interacting with the whales, these latter displaying avoidance behaviour. This encounter may be regarded as a negative interaction with short-term and nonlethal impacts on the whales. In addition, we present evidence that the sharksucker (Echeneis naucrates) is preyed on by the rough-toothed dolphin while interacting with the whales.

Acevedo-Gutiérrez, A., DiBerardinis, A., Larkin, S., Larkin, K., & Forestell, P. (2005). Social Interactions between Tucuxis and Bottlenose Dolphins in Gandoca-Manzanillo, Costa Rica. *Latin American Journal of Aquatic Mammals, 4*(1) Retrieved from https://www.wwu.edu/faculty/aceveda/PDFs/lab%20papers/Acevedo%2005%20Tursiops%20and%20Sotalia.pdf

Studies measuring the extent of interspecific interactions between dolphin species are rare. We observed free-ranging tucuxis (Sotalia fluviatilis) and bottlenose dolphins (Tursiops truncatus) to document the frequency of occurrence of interspecific interactions relative to group size and behavioral state. We conducted opportunistic surveys in Gandoca- Manzanillo (9º36'N, 82º35'W), Costa Rica. Of the 71 groups analyzed, 46.5% were comprised only of tucuxis, 21.1% of bottlenose dolphins, and 32.4% of the two species. Social behavior was more frequent in mixed-species groups and in groups larger than four dolphins; foraging was more frequent in single-species groups and in groups smaller than five dolphins. Photographic documentation and sightings of putative hybrids suggest the occurrence of hybridization between both dolphin species. Results indicate that tucuxis and bottlenose dolphins interacted frequently and that these interactions were predominantly social in nature. Future studies will discern whether these interactions result in the development of hybrids.

Bearzi, M. (2005). Dolphin Sympatric Ecology. *Marine Biology Research, 1*(3), 165-175 https://doi.org/10.1080/17451000510019132

Interspecific associations between two or more species of the family Delphinidae have been reported by many scientists, but the sympatric ecology of such dolphin associations has not been studied in great detail. A few field investigations have been conducted on this subject in different parts of the world on species such as bottlenose dolphins (Tursiops spp.), short-beaked common dolphins (Delphinus delphis), and killer whales (Orcinus orca). Sympatric dolphins seem to use different strategies to co-exist when resources appear to be limited, including dietary divergence (different prey preference, slightly diverse diet, different feeding time) and/or different habitat use (shallow versus deep waters, flat areas versus submarine canyons and escarpments, different travel routes). This paper presents a review of some well-studied dolphin species found in sympatry and discusses the nature of habitat and resource partitioning as well as studies on aggressive behaviour displayed by species living in the same habitat.

Dolar, M. L. L., Perrin, W. F., Taylor, B. L., Kooyman, G. L., & Alava, M. (2006). Abundance and Distributional Ecology of Cetaceans in the Central Philippines. *Journal of Cetacean Research and Management, 8*(1), 93 Retrieved from https://archive.iwc.int/?r=260&k=7ba9555a71

In general, little is known about cetacean abundance and distribution in Southeast Asia. This paper investigates the species composition, interactions/associations, abundance and distribution of cetaceans in an archipelagic tropical habitat characterised by deep, oceanic waters approaching the shore, high water temperatures and deep, stable thermoclines. Abundance is estimated using line transect methods. In addition, the cetacean fauna of the Sulu Sea is compared with those of other tropical marine ecosystems: the eastern tropical Pacific, the western Indian Ocean and the Gulf of Mexico. The most abundant species in the two study sites (eastern Sulu Sea and the Tañon Strait) was the spinner dolphin, Stenella longirostris; with a population estimate of 31,512 (CV=26.63%) in the eastern Sulu Sea and 3,489 (CV=26.47%) in the Tañon Strait. Other abundant species were the pantropical spotted dolphin (S. attenuata), Fraser's dolphin (Lagenodelphis hosei) and the short-finned pilot whale (Globicephala macrorhynchus). Density and species-abundance rank varied between the two study sites, with generally higher densities in the Sulu Sea than in the Tañon Strait. An exception was the dwarf sperm whale, Kogia sima, whose density was 15 times higher in the Tañon Strait. Fraser's dolphin ranked third in abundance in the Sulu Sea but was absent from the Tañon Strait. Environmental factors such as depth, site and temperature were observed to have a significant influence on the distributions of various species.

Lusseau, D., Wilson, B. E. N., Hammond, P. S., Grellier, K., Durban, J. W., Parsons, K. M., . . . Thompson, P. M. (2006). Quantifying the Influence of Sociality on Population Structure in Bottlenose Dolphins. *Journal of Animal Ecology, 75*(1), 14-24 https://doi.org/10.1111/j.1365-2656.2005.01013.x

1. The social structure of a population plays a key role in many aspects of its ecology and biology. It influences its genetic make-up, the way diseases spread through it and the way animals exploit their environment. However, the description of social structure in nonprimate animals is receiving little attention because of the difficulty in abstracting social structure from the description of association patterns between individuals. 2. Here we focus on recently developed analytical techniques that facilitate inference about social structure from association patterns. We apply them to the population of bottlenose dolphins residing along the Scottish east coast, to detect the presence of communities within this population and infer its social structure from the temporal variation in association patterns between individuals. 3. Using network analytical techniques, we show that the population is composed of two social units with restricted interactions. These two units seem to be related to known differences in the ranging pattern of individuals. By examining social structuring at different spatial scales, we confirm that the identification of these two units is the result of genuine social affiliation and is not an artefact of their spatial distribution. 4. We also show that the structure of this fission-fusion society relies principally on short-term casual acquaintances lasting a few days with a smaller proportion of associations lasting several years. These findings highlight how network analyses can be used to detect and understand the forces driving social organization of bottlenose dolphins and other social species.

Kiszka, J. J. (2007). Atypical Associations between Dugongs (Dugong dugon) and Dolphins in a Tropical Lagoon. *Journal of the Marine Biological Association of the United Kingdom, 87*(1), 101-104 https://doi.org/10.1017/S0025315407055129

Several types of relationships link organisms to each other, including competition, predation and various types of associations. This paper presents the first case of association/interaction between dugongs, Dugong dugon, the only strictly marine herbivorous mammal, and three species of tropical dolphins in and around the lagoon of Mayotte (45°10'E 12°50'S), in the western tropical Indian ocean. Data were collected opportunistically from 1999 to 2005 in the surrounding waters of Mayotte from boat (N=2 observations) and ULM (ultra-light motorized vessel, N=2). The dolphin species involved in associations with dugongs were Indo-Pacific bottlenose dolphin, Tursips aduncus, Indo-Pacific humpback dolphin, Sousa chinensis, and spinner dolphin, Stenella longirostris. In one case, dugongs were associated with both bottlenose and humpback dolphins. Associations were observed in the protected waters of the lagoon and outside, along the external slope of the barrier reef. Group size, activity and group structure of each species were recorded. Behavioural observations suggest that dugongs and dolphins were engaged in similar activities, such as travelling, on several occasions and were clearly associated when group formation was tight. If dolphins and dugongs may not associate for feeding purposes, then these interactions may occur: (1) for predation avoidance toward sharks; or (2) without any ecological reasons due to dolphin and dugong habitat overlap around the island.

MacLeod, C. D., & Bennett, E. (2007). Pan-Tropical Spotted Dolphins (Stenella attenuata) and Other Cetaceans around St Helena in the Tropical South-Eastern Atlantic. *Journal of the Marine Biological Association of the United Kingdom, 87*(1), 339-344 https://doi.org/10.1017/S0025315407052502

The occurrence, distribution and structure of cetacean communities in the tropical South Atlantic beyond the shelf edge are poorly known with little dedicated research occurring within this region. At 15°58'S 005°43'W, the island of St Helena is one of the few areas of land within this region and the only one that lies in the tropical south-eastern Atlantic. As a result, St Helena offers a unique opportunity to study cetaceans within this area using small boats and land-based observations. This paper describes the results of a preliminary, short-term survey of the cetacean community around St Helena in the austral winter of 2003. Pan-tropical spotted dolphins (Stenella attenuata) were the most numerous species recorded, followed by bottlenose dolphins (Tursiops truncatus) and rough-toothed dolphins (Steno bredanensis), a species not previously reported from St Helena. This last species was only recorded occurring in mixed groups with bottlenose dolphins. Pan-tropical spotted and bottlenose dolphins differed in their spatial distribution around St Helena. While pan-tropical spotted dolphins were primarily recorded resting in large groups in the lee of the island during daylight hours, bottlenose dolphins and rough-toothed dolphins were recorded closer to shore and on both the windward and lee sides. Humpback whales (Megaptera novaeangliae) were also recorded once during the survey, but interviews with local fishermen suggest that this species regularly occurs in the waters around St Helena in small numbers during the austral winter. The results of this preliminary survey suggest that the cetacean community around St Helena during this survey was relatively simple, consisting of up to three species that are present year-round and one seasonally occurring species in the nearshore waters, with a small number of additional species occurring occasionally in deeper offshore areas.

MacLeod, C. D., Weir, C. R., Pierpoint, & Harland, E. J. (2007). The Habitat Preferences of Marine Mammals West of Scotland (UK). *Journal of the Marine Biological Association of the United Kingdom, 87*(1), 157-164 https://doi.org/10.1017/S0025315407055270

This study used classification and regression trees (CART) to investigate and compare the habitat preferences of marine mammals in this area. Data were collected in early summer (June/July) in 2004 and 2005 and the distribution of marine mammal species was compared to 10 ecogeographic variables (EGVs). Of 13 species of marine mammals sighted during the study, there were sufficient sightings to examine the habitat preferences of seven. For all species a measure of 'shelf tendency' (distance to coast or water depth) was an important variable and the species could be separated into two groups, the deep-water species and the shelf species, with little overlap between them. The occurrence of both deep-water species (long-finned pilot whales and Atlantic white-sided dolphins) was also related to dynamic variables such as sea surface temperature (SST) or primary productivity. Two of the shelf species (northern minke whales and grey seals) were only linked to topographic variables and were limited to quite specific habitats. A third species (harbour porpoise) was primarily related to topographic variables, but in the shallowest waters was also related to local variation in SST. The occurrence of the final two species (common and white-beaked dolphins) was linked to SST and local primary productivity. However, while both species preferentially occurred in areas with higher productivity, the two species differed in their preference for SST, with common dolphins preferentially occurring in warmer waters and white-beaked dolphins in colder waters.

Maze-Foley, K., & Mullin, K. (2007). Cetaceans of the Oceanic Northern Gulf of Mexico: Distributions, Group Sizes and Interspecific Associations. *Journal of Cetacean Research and Management, 8*(2), 203 Retrieved from https://archive.iwc.int/?r=261&k=2b4857ba08

The Gulf of Mexico is a subtropical ocean basin with a diverse oceanic cetacean community. Cetacean research in the Gulf of Mexico has been driven by mandates of the US Marine Mammal Protection Act as well as concerns over the rapidly expanding oil and natural gas industry and related potential threats (e.g. seismic surveys, increased ship traffic, oil spills). Previously, cetacean distribution and abundances for specific Gulf of Mexico areas or species have been described based on work over periods of several years, and recently abundance estimates were made for the entire oceanic northern Gulf of Mexico (1996-2001). For each cetacean species, the paper describes distribution, group size, associated sea surface temperature and water depth and interspecific associations based on surveys conducted over 11 years that span the entire northern Gulf of Mexico. This dataset is the most comprehensive to date for the oceanic northern Gulf. Nine ship surveys totalling 45,462km of effort were conducted during spring seasons (1991-2001) in continental shelf-edge and oceanic waters (100m) of the northern Gulf of Mexico. Eighteen species were identified from 1,868 sightings. Cetaceans were found throughout the area although some species had localised distributions or occurred in restricted ranges of water depths. Spinner dolphins (Stenella longirostris) had the largest mean group size (n = 40, x– = 151.5, SE = 30.90), followed by melon-headed whales (Peponocephala electra), clymene dolphins (S. clymene), pantropical spotted dolphins (S. attenuata), Fraser's dolphins (Lagenodelphis hosei) and striped dolphins (S. coeruleoalba) (range of means 46.1-99.6). Beaked whales (Ziphiidae), Bryde's whales (Balaenoptera edeni/brydei), sperm whales (Physeter macrocephalus) and pygmy/dwarf sperm whales (Kogia spp.) were found in the smallest groups (x– < 3). Twenty-seven sightings (1.4% of all sightings) were composed of two cetacean species. Common bottlenose dolphins (Tursiops truncatus) were recorded in mixedspecies groups with more species than any other cetacean. Forty-five cetacean sightings (2.4% of all sightings) were associated with at least one bird species, and 21 (1.1% of all sightings) were associated with schools of fish. Contrary to previous reports, pantropical spotted dolphins were observed in association with both fish (including surface tunas) and seabirds, although to a lesser extent than for other tropical oceans. No mixed pantropical spotted and spinner dolphin groups were sighted despite their regular co-occurrence in other tropical oceans.

Seppänen, J.-T., Forsman, J. T., Mönkkönen, M., & Thomson, R. L. (2007). Social Information Use Is a Process across Time, Space, and Ecology, Reaching Heterospecifics. *Ecology, 88*(7), 1622-1633 https://doi.org/10.1890/06-1757.1

Decision making can be facilitated by observing other individuals faced with the same or similar problem, and recent research suggests that this social information use is a widespread phenomenon. Implications of this are diverse and profound: for example, social information use may trigger cultural evolution, affect distribution and dispersal of populations, and involve intriguing cognitive traits. We emphasize here that social information use is a process consisting of the scenes of (1) event, (2) observation, (3) decision, and (4) consequence, where the initial event is a scene in such a process of another individual. This helps to construct a sound conceptual framework for measuring and studying social information use. Importantly, the potential value of social information is affected by the distance in time, space, and ecology between the initial observation and eventual consequence of a decision. Because negative interactions between individuals (such as direct and apparent competition) also depend on the distance between individuals along these dimensions, the potential value of information and the negative interactions may form a trade-off situation. Optimal solutions to this trade-off can result in adaptively extended social information use, where using information gathered some time ago, some distance away, and from ecologically different individuals is preferred. Conceivably, using information gathered from a heterospecific individual might often be optimal. Many recent studies demonstrate that social information use does occur between species, and the first review of published cases is provided here. Such interaction between species, especially in habitat selection, has important consequences for community ecology and conservation. Adaptively extended social information use may also be an important evolutionary force in guild formation. Complex coevolutionary patterns may result depending on the effect of information use on the provider of information.

Vaughn, R. L., Shelton, D. E., Timm, L. L., Watson, L. A., & Wuersig, B. (2007). Dusky Dolphin (Lagenorhynchus obscurus) Feeding Tactics and Multi-Species Associations. *New Zealand Journal of Marine and Freshwater Research, 41*(4), 391-400 https://doi.org/10.1080/00288330709509929

In this study, monthly changes in dusky dolphin (Lagenorhynchus obscurus) feeding tactics and multi-species associations in Admiralty Bay and Current Basin, New Zealand were described from August to November 2005 and from May through August 2006. Concurrent changes in dusky dolphin abundance, prey characteristics, and locations of feeding bouts were examined. Data were collected during systematic surveys and focal follows of dolphin groups. During 335 dolphin feeding bouts (52 observed underwater), data were recorded on number of associated fur seal (Arctocephalus forsteri), seabirds, and sharks; dolphin behaviour; prey ball parameters; and locations. Dolphin feeding tactics, multi-species associations, and locations of feeding bouts were different from May through July than from August to November. From May through July, dolphins fed on mobile prey at depth; from August to November, they herded small schools of fish (including pilchard Sardinops neopilchardus) to the surface. Primarily shearwaters (Puffinus spp.) fed with dolphins from May through July; shearwaters, gannet (Morus serrator), gulls (Larus spp.), and fur seal frequently fed with dolphins from August to November. These intra-annual differences suggest that changes in prey species or behaviour influence dolphin feeding tactics, and influence which species benefit from feeding with dolphins.

Wade, P. R., Watters, G. M., Gerrodette, T., & Reilly, S. B. (2007). Depletion of Spotted and Spinner Dolphins in the Eastern Tropical Pacific: Modeling Hypotheses for Their Lack of Recovery. *Marine Ecology Progress Series, 343*, 1 https://doi.org/ 10.3354/meps07069

We assess the status of 2 dolphin stocks affected by purse-seine fishing in the eastern topical Pacific and evaluate hypotheses for their lack of recovery. We use Bayesian methods and fit generalized models of logistic population growth to abundance estimates for northeastern offshore spotted dolphins Stenella attenuata attenuata and eastern spinner dolphins Stenella longirostris orientalis. In 2002, using the definition of depletion stipulated in the USA Marine Mammal Protection Act, northeastern offshore spotted dolphins were almost certainly 'depleted'. There is, however, uncertainty in the degree to which the stock was depleted. Eastern spinner dolphins were most likely depleted in 2002, but there is a small probability that this was not the case. Uncertainty in the degree to which both stocks were depleted stems from uncertainties in maximum net productivity levels and carrying capacities. Based on abundance data from 1979 to 2000, both stocks were estimated to have had maximum growth rates of <3% yr–1 with >77% probability, lower than the accepted minimum default value for dolphin populations with reproductive parameters (e.g. calving intervals) like those considered here (Reilly & Barlow 1986, Fish Bull 84:527–533; Wade 1998, Mar Mamm Sci 14:1–37). We fit models that are intended to be indicative of hypotheses that explain why neither dolphin stock has recovered. Our data and prior information provide equal posterior support to hypotheses which attribute the lack of recovery to the fishery and changes in the ecosystem. We conclude that (1) the purse-seine fishery can impact dolphin stocks beyond the impacts of observed fishery mortality, (2) there is uncertainty about the degrees to which such cryptic impacts have population-level consequences, and (3) the existing dolphin-safe labeling standard is, from a conservation perspective, robust to this uncertainty.

Dulau-Drouot, V., Boucaud, V., & Rota, B. (2008). Cetacean Diversity Off La Réunion Island (France). *Journal of the Marine Biological Association of the United Kingdom, 88*(6), 1263-1272 https://doi.org/10.1017/S0025315408001069

The waters of La Réunion, a French island located in the south-western Indian Ocean, have never been investigated for cetacean diversity. Dedicated daily surveys were conducted in 2004–2007 to assess cetacean diversity off the western and southern coasts of the island. A total of ten species was observed during the survey period, including two baleen whales and eight odontocetes. Four additional species that had not been observed at sea were reported stranded. The most frequent delphinid species were the Indo-Pacific bottlenose, the spinner and the common bottlenose dolphins, which were observed year-round. Photo-identification data showed a high recapture rate of Tursiops aduncus, strongly suggesting a resident population. The humpback whale uses the coastal waters of La Réunion seasonally, during winter. The high proportion of mother–calf pairs indicated that La Réunion might represent a breeding area for this species. Pantropical spotted dolphin, melon-headed whale and Fraser's dolphin were sighted at a medium frequency, in offshore waters, and tended to favour the southern part of the island. Three coastal species were frequently using the newly created Marine Protected Area (MPA), supporting the view that cetacean conservation issues have to be included in the MPA management plan currently in progress.

Pereira, J. N. D. S. G. (2008). Field Notes on Risso's Dolphin (Grampus griseus) Distribution, Social Ecology, Behaviour, and Occurrence in the Azores. *Aquatic Mammals, 34*(4), 426-435 http://dx.doi.org/10.1578/AM.34.4.2008.426

This study reports new information on Grampus griseus (G. Cuvier, 1812) distribution with depth and slope, group size, general and interspecific behaviour, and calving intervals for the Azorean archipelago. Observations are in agreement with scarce previous work and most other regions in the North Atlantic and Mediterranean. Data were collected on 107 sightings south of Pico Island that took place between 17 May and 29 August 2003 from opportunistic research platforms. Information on occurrence, provided by an observer with 50 y of land-based cetacean experience, was included for comparison. Risso's dolphins preferred areas between 497 and 1,233 m depth (modal class 600 to 650 m; N = 69), with slopes between 27 and 35%, although these data require validation. The majority of groups were composed of up to 20 individuals (modal 6 to 10), averaging 12.3 (1 to 55; N = 74). Large socializing aggregations observed during July and August (55 to ~175 individuals) were similar to land-based observations between 1992 and 2005. G. griseus's diurnal activities in this study were mostly traveling (77%) and socializing (13%), with feeding (5%) and resting (3.7%) occurring less frequently. The first newborn calves are reported. Two-species groups and interactions with six cetacean species are described. Harassment behaviours with Globicephala spp. and Physeter macrocephalus suggest competitive interference. Year-round observations between 1992 and 2005 near Pico Island, together with birth reports and recent data on site fidelity, suggest population residency.

Querouil, S., Silva, M. A., Cascao, I., Magalhaes, S., Seabra, M. I., Machete, M. A., & Santos, R. S. (2008). Why Do Dolphins Form Mixed-Species Associations in the Azores? *Ethology, 114*(12), 1183-1194 https://doi.org/10.1111/j.1439-0310.2008.01570.x

Mixed-species associations are temporary associations between individuals of different species that are often observed in birds, primates and cetaceans. They have been interpreted as a strategy to reduce predation risk, enhance foraging success and/or provide a social advantage. In the archipelago of the Azores, four species of dolphins are commonly involved in mixed-species associations: the common dolphin, Delphinus delphis, the bottlenose dolphin, Tursiops truncatus, the striped dolphin, Stenella coeruleoalba, and the spotted dolphin, Stenella frontalis. In order to understand the reasons why dolphins associate, we analysed field data collected since 1999 by research scientists and trained observers placed onboard fishing vessels. In total, 113 mixed-species groups were observed out of 5720 sightings. The temporal distribution, habitat (water depth, distance to the coast), behaviour (i.e. feeding, travelling, socializing), size and composition of mixed-species groups were compared with those of single-species groups. Results did not support the predation avoidance hypothesis and gave little support to the social advantage hypothesis. The foraging advantage hypothesis was the most convincing. However, the benefits of mixed-species associations appeared to depend on the species. Associations were likely to be opportunistic in the larger bottlenose dolphin, while there seemed to be some evolutionary constraints favouring associations in the rarer striped dolphin. Comparison with previous studies suggests that the formation of mixed-species groups depends on several environmental factors, and therefore may constitute an adaptive response.

Stockin, K. A., Pierce, G. J., Binedell, V., Wiseman, N., & Orams, M. B. (2008). Factors Affecting the Occurrence and Demographics of Common Dolphins (Delphinus Sp.) in the Hauraki Gulf, New Zealand. *Aquatic Mammals, 34*(2), 200-211 https://doi.org/10.1578/AM.34.2.2008.200

The common dolphin (Delphinus sp.) is the most frequently observed cetacean species in the Hauraki Gulf, a large shallow body of water on the northeastern coastline of North Island, New Zealand. Herein,

we present the first data relating to the occurrence and distribution of common dolphins in this region and assess the possible effects of abiotic parameters on the demographics of this population. The presence of associated marine species is quantified, and differences in the occurrence and demographics of single and multi-species groups are examined. Sightings data were collected between February 2002 and January 2005 during boat-based surveys. We recorded 719 independent encounters with common dolphins, involving 1 to > 300 animals. Dolphin presence was significantly affected by month, latitude and depth. Group size varied significantly by month, season, depth, sea surface temperature (SST) and latitude, and was highly skewed towards smaller groups made up of < 50 animals. Larger aggregations were most frequent during the austral winter when nutrient upwelling typically leads to increased prey availability within the region. Over 70% of groups encountered contained immature animals and 25% of groups included neonates. Calves were observed throughout the year but were most prevalent in the austral summer months of December and January. Month, season, depth, and SST significantly affected group composition. Common dolphins were observed in association with four cetacean and eight avian species, most frequently with the Australasian gannet (Morus serrator) and the Bryde's whale (Balaenoptera brydei). The distribution of dolphin-only groups differed significantly from that of dolphin-whale groups, with mono-specific groups found on average in waters that were 3.6 m shallower and 3.1°C warmer. The year-round occurrence and social organisation of common dolphins in Hauraki Gulf waters suggest this region is important both as a calving and nursery ground.

Gannier, A. (2009). Comparison of Odontocete Populations of the Marquesas and Society Islands (French Polynesia). *Journal of the Marine Biological Association of the United Kingdom, 89*(5), 931-941 https://doi.org/10.1017/S0025315408002713

Small boat surveys were organized to study cetaceans of the Marquesas (9°S and 140°W) and the Society Islands (17°S and 150°W) in French Polynesia. Prospecting took place from 12-15 m sailboats, between 1996 and 2001 with systematic visual searching. Boats moved according to sea conditions, at a mean speed of 10 km/h. Effective effort of 4856 km in the Marquesas and 10,127 km in the Societies were logged. Relative abundance indices were processed for odontocetes using data obtained with Beaufort 4 or less. In the Marquesas, 153 on-effort sightings were obtained on 10 delphinids species including the spotted dolphin, spinner dolphin, bottlenose dolphin, melon-headed whale and rough-toothed dolphin. In the Societies, 153 sightings of 12 odontocetes included delphinids (spinner, rough-toothed and bottlenose dolphins, short-finned pilot and melon-headed whales, Fraser's dolphin, Risso's dolphin and pygmy killer whale) and two species of beaked whales, the sperm whale and dwarf sperm whale. Relative abundance indices were higher in the Marquesas than in the Societies both inshore (0.93 ind/km2 against 0.36 ind/km2) and offshore (0.28 ind/km2 against 0.14 ind/km2). Differences in remote-sensed primary production were equally important, the Marquesas waters featuring an annual average of 409 mgC.m-2 · day-1 and the Societies of only 171 mgC · m-2 · day-1. The presence of a narrow shelf around the Marquesas also accounted for differences in odontocete populations, in particular the delphinids.

Melillo, K. E., Dudzinski, K. M., & Cornick, L. A. (2009). Interactions between Atlantic Spotted (Stenella Frontalis) and Bottlenose (Tursiops Truncatus) Dolphins Off Bimini, the Bahamas, 2003-2007. *Aquatic Mammals, 35*(2), 281-291 https://doi.org/10.1578/AM.35.2.2009.281

Interspecific interactions have been observed in a variety of social animals. Functional explanations include foraging, anti-predatory, and social advantages. These behaviors are poorly understood in marine mammals but are increasingly studied phenomena in sympatric populations. Resident Atlantic spotted dolphins (Stenella frontalis) off Bimini, The Bahamas, have been the subject of ongoing photo-identification and behavioral studies since 2001. A lesser-known population of bottlenose dolphins (Tursiops truncatus) has been observed interacting with these S. frontalis since 2003. To examine the functional significance of these interactions, interspecific behaviors were documented with underwater video using focal animal sampling. Mating or sexual play were the primary activities observed in nearly 50% of interactions, with male T. truncatus as the initiators. Therefore, the most likely functional explanation for these interactions is social. We hypothesize that male T. truncatus which lack access to T. truncatus females because of sexual immaturity or low social status seek copulations with S. frontalis females as an alternative.

Pruitt, J., Taylor, J., & Troupe, J. (2009). Foraging Benefits and Limited Niche Overlap Promote a Mixed Species Association between Two Solitary Species of Spider. *Behaviour, 146*(8), 1153-1170 Retrieved from https://www.jstor.org/stable/40296120

Mixed species associations are of general importance because of the diversity of ecological relations they can represent (e.g., mutualisms, commensalisms, exploitative relationships). We test for a non-random association between two normally solitary species of spider, the black widow (Latrodectus mactans) and the orchard spider (Leucage venusta). We use field observations comparing solitary and associated individuals of both species to elucidate what effect the association has on prey capture. We then evaluate what influence the association has on prey consumption, as inferred from change in body mass after a reciprocal removal experiment. From our field census we confirm that these species associate non-randomly in wild populations; furthermore, we failed to detect a difference in the number or kinds of prey which hit solitary and associated webs of either species, suggesting the association is not merely an aggregation to microhabitats which afford higher prey availability. Our observational data on prey capture indicate the association serves to increase the capture efficiency of, in part through ricocheted prey, but we failed to detect a prey capture effect for . The results of our reciprocal removal experiment suggest the relationship is a commensalism: benefiting and leaving unaffected.

Rossi-Santos, M. R., Santos-Neto, E., & Baracho, C. G. (2009). Interspecific Cetacean Interactions During the Breeding Season of Humpback Whale (Megaptera Novaeangliae) on the North Coast of Bahia State, Brazil. *Journal of the Marine Biological Association of the United Kingdom, 89*(5), 961-966 https://doi.org/10.1017/s0025315409000897

The large majority of cetacean interspecific studies report only on dolphin interactions, while studies on interactions between odontocete and mysticete are less common. The present work aims to report on sightings of cetacean interactions, during the breeding season of humpback whales (Megaptera novaeangliae), along 370 km of the Bahia State, north-eastern Brazil, addressing aspects of cetacean distribution and behaviour. During 7 seasons (2000-2006), a total of 230 research cruises were performed, in which 38 events of interactions among humpback whales and other cetaceans (Tursiops truncatus, Steno bredanensis, Peponocephala electra and Balaenoptera acutorostrata) were observed, plus another 5 encounters without the whale's presence, including T. truncatus, S. bredanensis, P. electra, Stenella clymene and Stenella attenuata. Our results confirm the occurrence of multiple cetacean species in the Bahia State, being the first study in the world to report on a large range of

interactions involving another 4 cetacean species, grouped with up to 3 mixed species per sighting, with humpback whales in their annual breeding ground.

Weir, C. R., Macleod, C. D., & Calderan, S. V. (2009). Fine-Scale Habitat Selection by White-Beaked and Common Dolphins in the Minch (Scotland, UK): Evidence for Interspecific Competition or Coexistence? *Journal of the Marine Biological Association of the United Kingdom, 89*(5), 951-960 https://doi.org/10.1017/S0025315408003287

A decline in white-beaked dolphins Lagenorhynchus albirostris had been reported in the Minch (Scotland, UK) since the 1990s, coinciding with an increasing occurrence of short-beaked common dolphins Delphinus delphis. This has led to suggestions that rising seawater temperatures are causing D. delphis to out-compete and exclude L. albirostris in this region. A total of 793 km (66.3 hours) of survey data were collected in the Minch during August 2007, to examine fine-scale habitat selection by L. albirostris and D. delphis and investigate whether their ecological overlap is sufficient to result in interspecific competition and/or habitat partitioning. Ten sightings of L. albirostris (70 animals) were recorded in a relatively small spatial area in the northern Minch. In contrast, the eleven sightings of D. delphis (1486 animals) were more widely distributed. The relative abundance per 1/4 ICES rectangle ranged from 0.41 to 0.53 animals/km for L. albirostris and 0.13 to 6.68 animals/km for D. delphis. The mean group size and group body mass were higher for D. delphis than for L. albirostris indicating D. delphis as the dominant delphinid in the Minch during August. Lagenorhynchus albirostris occurred in waters significantly deeper and further from shore than D. delphis, suggesting interspecific differences in preferred habitat. Most dolphin schools were recorded as foraging/feeding. Behaviour and seabird associations indicated that the two species differed in diet and/or foraging strategy, with L. albirostris foraging sub-surface and D. delphis exhibiting surface-feeding with associated gannets Morus bassanus. This is consistent with published information on the stomach contents of Scottish animals. The results suggest that there are subtle differences in habitat selection and diet between these two species, which may enable L. albirostris and D. delphis to coexist in the Minch. Whether these differences result from niche partitioning arising from previous/ongoing interspecific competition or are the result of genuine differences in the habitat preferences of each species, remains unclear.

2010s

Deakos, M. H., Branstetter, B. K., Mazzuca, L., Fertl, D., & Mobley, J. R., Jr. (2010). Two Unusual Interactions between a Bottlenose Dolphin (Tursiops truncatus) and a Humpback Whale (Megaptera novaeangliae) in Hawaiian Waters. *Aquatic Mammals, 36*(2), 121-128 https://doi.org/10.1578/AM.36.2.2010.121

When two species share a common habitat, interspecific interactions can take many forms. Understanding the dynamics of these interactions can provide insight into the behavior and ecology of those species involved. Two separate, unusual interactions are described in which a humpback whale (Megaptera novaeangliae) lifted a bottlenose dolphin (Tursiops truncatus) completely out of the water. Both incidents occurred in Hawaiian waters. Based on reports of object play by humpback whales, and the apparent initiation and cooperation of each dolphin being lifted, object (i.e., the dolphin) play by the whale and social play by the dolphin seem to be the most plausible explanations for the interaction. Aggressive and epimeletic behavior by the humpback were also considered. [PUBLICATION ABSTRACT]

Goodale, E., Beauchamp, G., Magrath, R. D., Nieh, J. C., & Ruxton, G. D. (2010). Interspecific Information Transfer Influences Animal Community Structure. *Trends in Ecology & Evolution, 25*(6), 354-361 https://doi.org/10.1016/j.tree.2010.01.002

Acquiring information from the cues and signals of other species of the same trophic level is widespread among animals, and can help individuals exploit resources and avoid predators. But can such interspecific information transfer also influence the spatial structure of species within communities? Whereas some species use heterospecific information without changing their position, we review research that indicates that heterospecific information is a driving factor in the formation or maintenance of temporary or stable mixed-species groups. Heterospecific information can also influence the organization of such groups, including leadership. Further, animals sometimes select habitats using heterospecific information. We survey interspecific information transfer, and evaluate the morphological, ecological and behavioral factors that make some species information sources and others information seekers.

Krams, I. (2010). Interspecific Communication. In *Encyclopedia of Animal Behavior.* (pp. 196-202) https://doi.org/10.1016/B978-0-08-045337-8.00009-7

To survive, many animals stay as members of mixed-species associations. Indeed, there are a variety of social contexts in which two or more individuals belonging to different species must integrate their activities to achieve a common goal. The ability for heterospecific recognition and interspecific communication is the glue that holds these animal societies together. While we have been able to document a number of aspects of mixed-species associations, interspecific communication is a field of considerable debate as there is no concrete definition of what constitutes this type of communication. The field of interspecific communication awaits more research in the future especially because of close links between cooperative behavior and its cognitive demands.

Schmidt, K. A., Dall, S. R. X., & van Gils, J. A. (2010). The Ecology of Information: An Overview on the Ecological Significance of Making Informed Decisions. *Oikos, 119*(2), 304-316 https://doi.org/10.1111/j.1600-0706.2009.17573.x

Information is characterized as the reduction of uncertainty and by a change in the state of a receiving organism. Thus, organisms can acquire information about their environment that reduces uncertainty and increases their likelihood of choosing a best-matching strategy. We define the ecology of information as the study of how organisms acquire and use information in decision-making and its significance for populations, communities, landscapes and ecosystems. As a whole, it encompasses the reception and processing of information, decision-making, and the ecological consequences of making informed decisions. The first two stages constitute the domains of, e.g. sensory ecology and behavioral ecology. The exploration of the consequences of information use at larger spatial and temporal scales in ecology has lagged behind these other disciplines. In our overview we characterize information, discuss statistical decision theory as a quantitative framework to analyze information and decision-making, and discuss potential ecological ramifications. Rather than attempt a cursory review of the enormity of the scope of information we highlight information use in development, breeding habitat selection, and interceptive eavesdropping on alarm calls. Through these topics we discuss specific examples of ecological information use and the emerging ecological consequences. We emphasize recurring themes: information is collected from multiple sources, over varying temporal and spatial scales, and in many

cases links heterospecifics to one another. We conclude by breaking from specific ecological contexts to explore implications of information as a central organizing principle, including: information webs, information as a component of the niche concept, and information as an ecosystem process. With information having such an enormous reach in ecology we further cast a spotlight on the potential harmful effects of anthropogenic noise and info-disruption.

Smit, V., Ritter, F., Ernert, A., & Strueh, N. (2010). *Habitat Partitioning by Cetaceans in a Multi-Species Ecosystem around the Oceanic Island of La Gomera (Canary Islands).* Paper presented at the Annual Conference of the ECS, Stralsund, Germany. Retrieved from https://wwhandbook.iwc.int/es/downloadable-resources/searchable-database-of-scientific-literature/habitat-partitioning-by-cetaceans-in-a-multi-species-ecosystem-around-the-oceanic-island-of-la-gomera-canary-islands

Off the coast of La Gomera (Canary Islands), a multitude of cetacean species can be sighted. The presence and distribution as well as the combined occurrence of different species were monitored from regular whale watching vessels from 1995 until 2007. 5,739 cetacean sightings of 21 species were made. For the five most abundant species - bottlenose dolphins (Tursiops truncatus), short-finned pilot whales, (Globicephala macrorhynchus), Atlantic spotted dolphins, (Stenella frontalis), common dolphin (Delphinus delphis) and rough-toothed dolphins (Steno bredanensis) - physical characteristics of the sighting locations (distance to coast, depth and slope) were analysed and compared. It could be shown that each species prefers a specific set of habitat characteristics, while there is still a substantial overlap in distribution. Thus, off this subtropical oceanic island, where niche selection appears especially difficult because of relative homogeneity of the environment, it appears that a species' habitat selection can be driven by a combination of physical characteristics and the presence/absence of other cetacean species. This was underlined by the fact that none of the most abundant species occurred exclusively alone. Some of the multi-species aggregations were observed regularly, e.g. bottlenose dolphins were seen together with pilot whales during a large proportion of total sightings. On occasion the animals behaved like one group rather than an aggregation of two species. Other species, on the contrary, mostly, if not generally avoided any other cetaceans, i.e. the propensity of one species to mingle with another was selective. Some of the underlying reasons for this selectivity are discussed.

Thompson, L. M. (2010). *Long-Term Inter- and Intra-Species Interactions of Marine Tucuxi (Sotalia guianensis) and Common Bottlenose (Tursiops truncatus) Dolphins in Gandoca-Manzanillo, Costa Rica.* (Masters), Hofstra University, Retrieved from http://libweb.hofstra.edu/record=b2150975~S1

Bottlenose dolphins (Tursiops truncatus) regularly interact with other cetacean species throughout their range. Marine tucuxi (Sotalia guianensis) dolphins are a nervous delphinid threatened by novelty and not known to consort with any other cetacean species in the wild. The only documented location where these two species regularly interact is in the Gandoca-Manzanillo Wildlife Refuge, Costa Rica. Previous research on these mixed-species interactions suggested that bottlenose alliances participate in socio-sexual behaviors with tucuxi. It is currently not known if the bottlenose alliances are temporary or are maintained across years and little information exists on tucuxi behavior. There are three main hypotheses to this study: (1) The subset of bottlenose dolphins interacting with tucuxi form strong long-term alliances that extend across seasons for socio-sexual purposes; (2) The tucuxi involved are random,

and (3) Tucuxi do not exhibit any associative behavior. Opportunistic photographic and behavioral surveys were conducted twice daily for two week periods in January 2004 to 2010. A total of 3,510 photographs of dorsal fins were selected for identification. From these, 106 bottlenose, 59 tucuxi, and four putative hybrids were identified. Tucuxi groups were observed most frequently and mixed-species groups the least. Activity assessments were analyzed using Kruskal-Wallis and post-hoc Games-Howell Tests. Bottlenose groups evenly distributed their time across all activities, tucuxi groups spent significantly more time milling/resting and foraging/feeding, and mixed-species groups spent the most time engaged in socio-sexual behaviors. Average tucuxi group size was 10.63 individuals, bottlenose 8.10, and mixed-species group size 16.61. The average number of bottlenose found in mixed-species groups was found to be significantly less than the average number found in same-species groups, indicating that only a subset of bottlenose dolphins engaged in mixed-species activities. Coefficients of association for identified individuals were analyzed using SOCPROG 2.4. Results of this study confirmed pervious claims of sexual coercion of female tucuxi by male bottlenose alliances. The same bottlenose were found to repeatedly interact with tucuxi and form moderate to high associations. It was not definitively concluded whether the tucuxi involved in inter-species interactions were random. Both bottlenose and tucuxi were found to form intra-species alliances that were maintained across years and within same-species groups. Bottlenose alliances were reminiscent of primary alliances reported elsewhere. Bottlenose-tucuxi association patterns implicated cultural social learning as the pathway for bottlenose inter-species behavior transmission. While hybridization is fairly common amongst cetacean species, it has not been genetically substantiated in Gandoca-Manzanillo. However, dorsal fins have been photographed that are bottlenose in size, but tucuxi in shape. Further studies should delve into the possibility of bottlenose-tucuxi hybrids and also continue to document the inter-species sexual behaviors and intra-species association patterns proposed by the current study for further insight into their diffusion and influence.

Fulling, G. L., Thorson, P. H., & Rivers, J. (2011). Distribution and Abundance Estimates for Cetaceans in the Waters Off Guam and the Commonwealth of the Northern Mariana Islands. *Pacific Science, 65*(3), 321-343 https://doi.org/10.2984/65.3.321

Cetacean distribution and abundance are reported from the first systematic line-transect visual survey in the waters of Guam and the Commonwealth of the Northern Mariana Islands (CNMI). The survey was conducted during January-April 2007 following standard line-transect protocols. Trackline coverage (11,033 km) was dominated by high sea states (88.2%); however, 13 cetacean species were recorded. The sperm whale (Physeter macrocephalus) was the most frequently encountered whale, followed by Bryde's and sei whales (Balaenoptera edeni and B. borealis, respectively). Occurrence of the sei whale is unique, because the species had not been confirmed to occur south of 20° N. The pantropical spotted dolphin (Stenella attenuata) was the most frequently sighted delphinid, followed by the striped dolphin (Stenella coeruleoalba) and false killer whale (Pseudorca crassidens). Humpback whales (Megaptera novaeangliae) were acoustically detected and later seen off Saipan. Numerous cetacean sightings were associated with steep bathymetric features including the West Mariana Ridge, the Mariana Ridge, and the Mariana Trench. Abundance estimates were based on 80 on-effort sightings for 12 species. Species were pooled into three separate groups for estimating detection probabilities: Balaenoptera spp., blackfish (medium-size odontocetes), and small dolphins. A separate detection function was generated for the sperm whale. Precision of abundance estimates are very low for all species due to low sighting rates and high sea states; however, these abundance estimates serve as the best scientific data available for the area and establish vital baseline information for future research efforts.

Kiszka, J., Perrin, W. F., Pusineri, C., & Ridoux, V. (2011). What Drives Island-Associated Tropical Dolphins to Form Mixed-Species Associations in the Southwest Indian Ocean? *Journal of Mammalogy, 92*(5), 1105-1111 https://doi.org/10.1644/10-mamm-a-376.1

Mixed-species associations are temporary aggregations of individuals of different species involved in similar activities. Such associations form for foraging, protection against predators, and social advantage. Mixed-species groups in delphinids are frequent in the wild. We aimed to understand the ecological significance of mixed-species group formation by 2 tropical delphinids, the spinner dolphin (Stenella longirostris) and the pantropical spotted dolphin (Stenella attenuata), in waters surrounding the island of Mayotte in the southwestern Indian Ocean. We used sighting data collected year-round from 2004 to 2009. We encountered a total of 67 mixed-species groups (comprising 21% of all groups observed) of spinner and pantropical spotted dolphins around Mayotte. No daily or seasonal variability in the occurrence of associations was detected. Behavioral activities of single-and mixed-species groups differed significantly. Foraging was observed only in single-species groups of pantropical spotted dolphins. Mixed-species groups were larger than single-species groups. When in association, spinner dolphins used deeper waters than while in single-species groups. No evidence of association for social advantage was observed. We suggest that spinner dolphins associate with spotted dolphins for protection against predators when transiting between resting areas.

Weir, C. R. (2011). Distribution and Seasonality of Cetaceans in Tropical Waters between Angola and the Gulf of Guinea. *African Journal of Marine Science, 33*(1), 1-15 https://doi.org/10.2989/1814232X.2011.572333

The species richness, spatial distribution, seasonality and interspecific associations of cetaceans in tropical oceanic waters between the Gulf of Guinea and Angola were examined using 5 905.3 h of dedicated survey effort collected from 13 platforms of opportunity (geophysical vessels) between 2004 and 2009, and from incidental records. Most effort (87.8%) was recorded in waters >1 000 m deep. A total of 1 814 on-effort and 1 496 incidental sightings were recorded, comprising 22 species. Physeter macrocephalus and Megaptera novaeangliae were the most frequently sighted cetacean species, with Globicephala macrorhynchus and Stenella frontalis the most frequently sighted delphinids. Five species occurred in both neritic and oceanic waters, while the remainder had exclusively oceanic distributions. The occurrence of P. macrocephalus and M. novaeangliae differed significantly according to depth category. Most species occurred year-round; however, M. novaeangliae exhibited a strong, significant winter and spring occurrence. There were 65 interspecific groups recorded, involving at least 12 species. Mixed schools of G. macrorhynchus and Tursiops truncatus accounted for 55.4% of recorded associations. This extensive year-round dataset adds considerably to the understanding of cetacean distribution in the eastern tropical Atlantic and provides baseline information on which to base cetacean conservation and management in this poorly studied region.

Ilangakoon, A. D. (2012). *Cetacean Diversity and Mixed-Species Associations Off Southern Sri Lanka*. Paper presented at the Proceedings of the 7th International Symposium on SEASTAR2000 and Asian Bio-logging Science. http://hdl.handle.net/2433/154047

Sri Lanka, in the northern Indian Ocean island, has a relatively narrow continental shelf and an abundance of cetacean fauna in her waters. A few vessel surveys have produced data on cetacean occurrence off the east and west coast but no similar data exists for the south. To fill this data gap

vessel-based transects were carried out in 2008/2009 off a selected segment of the south coast. A high sighting rate was recorded and nine species were documented: Balaenoptera musculus, Balaenoptera brydei, Physeter macrocephalus, Stenella longirostris, Tursiops truncates, Pseudorca crassidens, Feresa attenuata, Orcinus orca and Globicephala macrorhynchus. Significantly the first scientifically documented sighting of O. orca anywhere in Sri Lanka‟s waters was recorded. Additionally blue whale feeding aggregations including mother-calf pairs were documented off southern Sri Lanka in the Austral summer. Mixed species associations involving five species of cetaceans were also recorded. The coastal waters off southern Sri Lanka are therefore an important cetacean habitat with high diversity and mixing of coastal and usually pelagic species. The implications of the importance of the area for blue whales also warrants further study and more detailed studies are recommended to generate data that can inform future management and conservation decisions.

Cantor, M., & Whitehead, H. (2013). The Interplay between Social Networks and Culture: Theoretically and among Whales and Dolphins. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences, 368*(1618), 20120340 Retrieved from https://doi.org/10.1098/rstb.2012.0340

Culture is increasingly being understood as a driver of mammalian phenotypes. Defined as group-specific behaviour transmitted by social learning, culture is shaped by social structure. However, culture can itself affect social structure if individuals preferentially interact with others whose behaviour is similar, or cultural symbols are used to mark groups. Using network formalism, this interplay can be depicted by the coevolution of nodes and edges together with the coevolution of network topology and transmission patterns. We review attempts to model the links between the spread, persistence and diversity of culture and the network topology of non-human societies. We illustrate these processes using cetaceans. The spread of socially learned begging behaviour within a population of bottlenose dolphins followed the topology of the social network, as did the evolution of the song of the humpback whale between breeding areas. In three bottlenose dolphin populations, individuals preferentially associated with animals using the same socially learned foraging behaviour. Homogeneous behaviour within the tight, nearly permanent social structures of the large matrilineal whales seems to result from transmission bias, with cultural symbols marking social structures. We recommend the integration of studies of culture and society in species for which social learning is an important determinant of behaviour.

Herzing, D. L., & Elliser, C. R. (2013). Directionality of Sexual Activities During Mixed-Species Encounters between Atlantic Spotted Dolphins (Stenella frontalis) and Bottlenose Dolphins (Tursiops truncatus). *International Journal of Comparative Psychology, 26*(2) Retrieved from https://escholarship.org/uc/item/3np7z795

In the Bahamas, interspecific groups of Atlantic spotted dolphins, Stenella frontalis, and bottlenose dolphins, Tursiops truncatus, have been observed underwater since 1985 on Little Bahama Bank. Mixed-species groups engage in associative behaviors and aggression on a regular basis. Because of their complex cognitive behaviors and large brain encephalization, dolphins are likely capable of complex social interactions, even between species.Between 1993-2003, 177 Mixed-Species Encounters (MSE) were categorized by the age class of male spotted dolphins, the ratio of spotted dolphins to bottlenose dolphins, behavior as Associative (traveling, babysitting, play) or Aggressive (chases, mounting, head to heads) and by directionality of sexual behavior. The majority (68%) of MSE involved adult spotted

dolphin. Associative behaviors were observed more than aggressive behaviors in groups where no adult male spotted dolphin, only male calves, or male juvenile spotted dolphins were present. Aggressive behaviors were observed more frequently than associative behaviors in adult male spotted dolphin groups. When groups were unbalanced in favor of one species or the other, differences in social interactions occurred. Male spotted dolphins were never observed attempting to mount male bottlenose dolphin although they chased them. Despite the larger ratio of male spotted dolphins to bottlenose dolphins during MSE, directionality of male-to-male sexual contact was primarily one-way. Male bottlenose dolphin mounted and copulated with male spotted dolphins but not the reverse. Opportunities for cross-species mating and hybridization clearly occurred. Male bottlenose dolphins copulated with female spotted dolphins and male spotted dolphins copulated with female bottlenose dolphins. These sympatric dolphins in the Bahamas have a complex and dynamic relationship that varies with sex and age and revolves around potential reproductive isolation issues.

Tiongson, A. J. C., & Sabater, E. R. (2013). *Patterns of Mixed-Species Associations of Small Cetaceans in the Northwest Bohol Sea*. Paper presented at the 20th Biennial Conference on the Biology of Marine Mammals, Dunedin, New Zealand. Poster Retrieved from https://www.researchgate.net/publication/289893678_Patterns_of_mixed-species_associations_of_small_cetaceans_in_the_Northwest_Bohol_Sea

Mixed-species associations are common occurrences for small cetaceans globally and the northwest Bohol Sea is no exemption - a likely deep, nearshore daytime resting area. Results from surveys conducted within three years showed a pattern of species mixing. Eight species were encountered, in decreasing frequency: melon-headed whale Peponocephala electra, Fraser's dolphin Lagenodelphis hosei, spinner dolphin Stenella longirostris, Risso's dolphin Grampus griseus, Indo-pacific bottlenose dolphin Tursiops aduncus, dwarf sperm whale Kogia sima, short-finned pilot whale Globicephala macrorhynchus, and Pantropical spotted dolphin Stenella attenuata. Mixed-species encounters was observed to be most frequent between the melon-headed whale and Fraser's dolphin (i.e. 66% of the time) followed by Fraser's and Risso's dolphin mixed-groups. These three species are much more frequently observed in mixed-groups compared to the spinner dolphins despite its relatively high encounter rate. Information from studies of resource partitioning of the concerned species were related to examine the ecological significance of mixing and non-mixing among certain species of small cetaceans. Interspecies co-occurrence may be a foraging strategy wherein shared prey resources play a role - perhaps giving an advantage through larger, more efficient foraging pods. Those species that forage in deeper waters associate more frequently with other species with similar foraging niches while those that occupy a different vertical foraging niche and preferred prey species may associate with like.

Wang, X. Y., Wu, F. X., Mou, J. F., & Zhu, Q. (2013). Indo-Pacific Humpback Dolphins (Sousa chinensis) Assist a Finless Porpoise (Neophocaena phocaenoides sunameri) Calf: Evidence from Xiamen Waters in China. *Journal of Mammalogy, 94*(5), 1123-1130 https://doi.org/10.1644/13-mamm-a-064.1

Interactions between cetacean species are common events that can lead to the formation of mixed-species groups, which have been reported in both captive and wild odontocetes. However, mixed groups containing Indo-Pacific humpback dolphin (Sousa chinensis) and the finless porpoise

(Neophocaena phocaenoides) rarely have been seen, and detailed interactions between these 2 species have been limited. For the first time, this paper describes wild Indo-Pacific humpback dolphins assisting a finless porpoise (N. p. sunameri) calf in Xiamen waters, China. A group of 8 humpback dolphins amicably herded a finless porpoise calf for more than 3 h. The humpback dolphins accompanied the finless porpoise calf and took turns pushing the calf out of the water to breathe. This paper provides a detailed behavioral description of these interactions, and we discuss the potential causes of this event.

Weir, C. R., Collins, T., Cross, T., Gill, A., Elwen, S., Unwin, M., & Parnell, R. J. (2013). False Killer Whale (Pseudorca crassidens) Sightings in Continental Shelf Habitat Off Gabon and Côte D'ivoire (Africa). *Marine Biodiversity Records, 6*, 9 https://doi.org/10.1017/S1755267213000389

The false killer whale Pseudorca crassidens is currently documented from only six eastern tropical Atlantic (ETA) range states, five of which are evidenced by strandings, by-catch or skeletal remains rather than at-sea sightings and consequently provide no information on habitat or behaviour. Here we report six false killer whale records from cetacean surveys carried out off Gabon (four records) and Côte d'Ivoire (two records) between 2002 and 2012, providing the first at-sea sightings in those two existing range states. All six sightings were located in continental shelf waters (< or =103 m depth) and in relatively nearshore (mean = 13.9 km) habitat. Forty-three false killer whales were photo-identified during three encounters on the Gabonese shelf; seven individuals were matched between 2002 and 2006, including two individuals that were present during all three sightings. Observations included predation of Atlantic sailfish Istiophoms albicans and two occurrences in proximity to humpback whales Megaptera novaeangliae. Whistles recorded during one sighting had simple structure, short duration and a mean fundamental frequency of 7.8 kHz. These are the first verified records of false killer whales using continental shelf waters in the ETA, indicating that the species occupies neritic habitat in the region in addition to its previously-documented oceanic habitat. The re-sightings of marked individuals between sightings and years suggest that at least some individuals exhibit a degree of site fidelity to Gabonese shelf waters. Further information on distribution, abundance, movements, population structure and mortality rates are required for effective management of the species in the ETA.

Wilson, A. D. M., & Krause, J. (2013). Repeated Non-Agonistic Interactions between a Bottlenose Dolphin (Tursiops Truncatus) and Sperm Whales (Physeter Macrocephalus) in Azorean Waters. *Aquatic Mammals, 39*(1), 89-96 https://doi.org/10.1578/AM.39.1.2013.89

In this paper, the authors report rare underwater observations of repeated non-agonistic interactions between an adult male bottlenose dolphin (Tursiops truncatus) with a vertebral column malformation and a group or groups of sperm whales (Physeter macrocephalus) in the Azores in September 2011. All observations took place approximately 15 to 20 km offshore from Lajes do Pico on the southern coast of the island of Pico. On 3 d over an 8-d study period (representing six total observations), a single bottlenose dolphin was observed with one or more variably sized groups of sperm whales. Sperm whale calves or subadults (n = 1 to 3) and adult females (n = 1 to 2) were present in all observations. All observations occurred while the mixed species groups were either socializing or swimming in a directed manner in close proximity at or near the surface (Weilgart & Whitehead, 1990).

Zaeschmar, J. R., Dwyer, S. L., & Stockin, K. A. (2013). Rare Observations of False Killer Whales (Pseudorca Crassidens) Cooperatively Feeding with Common Bottlenose Dolphins (Tursiops

Truncatus) in the Hauraki Gulf, New Zealand. *Marine Mammal Science, 29*(3), 555-562 https://doi.org/10.1111/j.1748-7692.2012.00582.x

Multi-species associations of odontocetes remain poorly understood. While their occurrence is occasionally reported, the driving factors behind these interactions are often difficult to ascertain. False killer whales (Pseudorca crassidens) are known to associate with a number of other odontocete species, in particular the common bottlenose dolphin (Tursiops truncatus)(e.g., Leatherwood et al. 1989). However, little is known about the function or extent of these associations.

Beauchamp, G. (2014). *Social Predation : How Group Living Benefits Predators and Prey* (First edition. ed.). Academic Press. https://doi.org/10.1016/C2012-0-03532-6

The classic literature on predation dealt almost exclusively with solitary predators and their prey. Going back to Lotka-Volterra and optimal foraging theory, the theory about predation, including predator-prey population dynamics, was developed for solitary species. Various consequences of sociality for predators have been considered only recently. Similarly, while it was long recognized that prey species can benefit from living in groups, research on the adaptive value of sociality for prey species mostly emerged in the 1970s. The main theme of this book is the various ways that predators and prey may benefit from living in groups. The first part focuses on predators and explores how group membership influences predation success rate, from searching to subduing prey. The second part focuses on how prey in groups can detect and escape predators. The final section explores group size and composition and how individuals respond over evolutionary times to the challenges posed by chasing or being chased by animals in groups. This book will help the reader understand current issues in social predation theory and provide a synthesis of the literature across a broad range of animal taxa.

Cords, M., & Würsig, B. (2014). A Mix of Species: Associations of Heterospecifics among Primates and Dolphins. In *Primates and Cetaceans: Field Research and Conservation of Complex Mammalian Societies.* J. Yamagiwa & L. Karczmarski (Eds.), (pp. 409-431). Tokyo: Springer Japan https://doi.org/10.1007/978-4-431-54523-1_21

Among mammals, associations of two or more species are likely to involve taxa that are also gregarious intraspecifically, such as primates and delphinids. Although these two groups generally differ in habitat, diet, and the stability of their social units, they share mixed-species association as a conspicuous aspect of their behavior. We compare the general features of such associations in both groups and review the evidence for particular adaptive explanations and proximate mechanisms. On the whole, delphinid associations seem more likely to involve fluid individual membership and hybridization. Random chance seems unlikely to explain many associations in both taxa, but it can be challenging to rule out a shared attraction to environmental features as a driver. Both antipredator and foraging-benefit functions of mixed-species grouping are more directly supported for primates than for dolphins but are plausible adaptive explanations for both groups. Costs of association are better supported in primates, which face feeding competition and increased energetic burden; for dolphins, these costs appear to be minimal, and direct heterospecific social interactions, including harassment, may be more important. Vocal and visual signals may mediate associations, but comparatively little is known about such proximate mechanisms in comparison to adaptive function. Future study of delphinid associations will benefit from some of the approaches taken by primatologists, including the comparison of animals in and out of

association, the correlation of association with environmental variables, and the comparison of different communities with different demographic or ecological characteristics.

Hodgins, N. K., Dolman, S. J., & Weir, C. R. (2014). Potential Hybridism between Free-Ranging Risso's Dolphins (Grampus Griseus) and Bottlenose Dolphins (Tursiops Truncatus) Off North-East Lewis (Hebrides, UK). *Marine Biodiversity Records, 7*, 7 https://doi.org/10.1017/S175526721400089X

Hybrid cetaceans have been documented to occur both in the wild and in captivity. Identifying wild hybrid individuals can be problematic in the absence of genetic techniques, but published accounts indicate that intermediate morphological characteristics are often present. Between 2010 and 2013, a land-based and boat-based study of the Risso's dolphin (Grampus griseus) was carried out in nearshore waters around the Eye Peninsula located on north-east Lewis, Scotland. Three atypical individuals were photographed which exhibited morphological features intermediate between Grampus and the common bottlenose dolphin (Tursiops truncatus). These individuals were typically larger in body size than Tursiops, and had a dorsal fin shape and size consistent with Grampus. Two individuals had coloration most similar to Tursiops and the third exhibited extensive white linear scarring consistent with Grampus. The intermediate morphology was most apparent in the head shape, with all three individuals exhibiting a defined (in contrast to Grampus) but very short (compared with Tursiops) rostrum and two having an unusually steep (compared with Tursiops) forehead. On one occasion, one of the atypical individuals was observed within a mixed-species school of Grampus and Tursiops. There were four further sightings of atypical dolphins associated with Tursiops-only schools. Atypical dolphins were not recorded within Grampus-only schools. These observations are consistent with hybridization between free-ranging Risso's and bottlenose dolphins, the first such occurrence to be documented for these species in UK waters. The context and significance of these hybridization events are unknown.

Smultea, M. A., Bacon, C. E., Lomac-Macnair, K., Visser, F., & Bredvik, J. (2014). Rare Mixed-Species Associations between Sperm Whales and Risso's and Northern Right Whale Dolphins Off the Southern California Bight: Kleptoparasitism and Social Parasitism? *Northwestern Naturalist, 95*(1), 43-49 Retrieved from www.jstor.org/stable/43286443

[No abstract available]

Zaeschmar, J. R., Visser, I. N., Fertl, D., Dwyer, S. L., Meissner, A. M., Halliday, J., . . . Stockin, K. A. (2014). Occurrence of False Killer Whales (Pseudorca Crassidens) and Their Association with Common Bottlenose Dolphins (Tursiops Truncatus) Off Northeastern New Zealand. *Marine Mammal Science, 30*(2), 594-608 https://doi.org/10.1111/mms.12065

On a global scale, false killer whales (Pseudorca crassidens) remain one of the lesser-known delphinids. The occurrence, site fidelity, association patterns, and presence/absence of foraging in waters off northeastern New Zealand are examined from records collected between 1995 and 2012. The species was rarely encountered; however, of the 61 distinctive, photo-identified individuals, 88.5% were resighted, with resightings up to 7yr after initial identification, and movements as far as 650km documented. Group sizes ranged from 20 to ca. 150. Results indicate that all individuals are linked in a single social network. Most observations were recorded in shallow (<100m) nearshore waters. Occurrence in these continental shelf waters is likely seasonal, coinciding with the shoreward flooding of

a warm current. During 91.5% of encounters, close interspecific associations with common bottlenose dolphins (Tursiops truncatus) were observed. Photo-identification reveals repeat inter- and intraspecific associations among individuals with 34.2% of common bottlenose dolphins resighted together with false killer whales over 1,832 d. While foraging was observed during 39.5% of mixed-species encounters, results suggest that social and antipredatory factors may also play a role in the formation of these mixed-species groups.

Sanderson, J. G., & Pimm, S. L. (2015). *Patterns in Nature: The Analysis of Species Co-Occurrences*. Chicago: The University of Chicago Press. Retrieved from https://www.press.uchicago.edu/ucp/books/book/chicago/P/bo21386354.html

What species occur where, and why, and why some places harbor more species than others are basic questions for ecologists. Some species simply live in different places: fish live underwater; birds do not. Adaptations follow: most fish have gills; birds have lungs. But as Patterns in Nature reveals, not all patterns are so trivial. Travel from island to island and the species change. Travel along any gradient—up a mountain, from forest into desert, from low tide to high tide on a shoreline —and again the species change, sometimes abruptly. What explains the patterns of these distributions? Some patterns might be as random as a coin toss. But as with a coin toss, can ecologists differentiate associations caused by a multiplicity of complex, idiosyncratic factors from those structured by some unidentified but simple mechanisms? Can simple mechanisms that structure communities be inferred from observations of which species associations naturally occur? For decades, community ecologists have debated about whether the patterns are random or show the geographically pervasive effect of competition between species. Bringing this vigorous debate up to date, this book undertakes the identification and interpretation of nature's large-scale patterns of species co-occurrence to offer insight into how nature truly works. Patterns in Nature explains the computing and conceptual advances that allow us to explore these issues. It forces us to reexamine assumptions about species distribution patterns and will be of vital importance to ecologists and conservationists alike.

Santoro, R., Sperone, E., Tringali, M., Pellegrino, G., Giglio, G., Tripepi, S., & Arcangeli, A. (2015). Summer Distribution, Relative Abundance and Encounter Rates of Cetaceans in the Mediterranean Waters Off Southern Italy (Western Ionian Sea and Southern Tyrrhenian Sea). *Mediterranean Marine Science, 16*(3), 613-620 https://doi.org/10.12681/mms.1007

During the summers of 2010 and 2011, weekly cetacean surveys were undertaken in "passing mode", using ferries as platforms of opportunity, along the "fixed line transect" between Catania and Civitavecchia (southern Italy). Of the 20 species of cetaceans confirmed for the Mediterranean Sea, eight were sighted within the survey period, of which seven species represented by Mediterranean subpopulations (Balaenoptera physalus, Physeter macrocephalus, Stenella coeruleoalba, Delphinus delphis, Grampus griseus, Tursiops truncatus and Ziphius cavirostris) and one is considered a visitor (Steno bredanensis). A total of 220 sightings were effected during 2010 and a total of 240 sightings in 2011. The most frequently recorded species was S. coeruleoalba. By the comparison the data from the two sampling seasons, a significant increase of D. delphis sightings and a decrease of sightings of B. physalus and P. macrocephalus were observed. While all the other species were observed in both sampling seasons, Z. cavirostris and Steno bredanensis were observed only during 2011. The presence of mixed groups of odontocetes was also documented: groups composed of pairs of species were S. coeruleoalba and D. delphis, S. coeruleoalba and T. truncatus, and S. coeruleoalba and G. griseus. The

results of this research add useful information on cetacean species in a very poorly known area and highlight the need to standardize large-scale and long-term monitoring programs in order to detect variation in presence, abundance and distribution of cetaceans populations and understand the effect of anthropogenic factors.

Svendsen, G. M., Romero, M. A., Williams, G. N., Gagliardini, D. A., Crespo, E. A., Dans, S. L., & Gonzalez, R. A. (2015). Environmental Niche Overlap between Common and Dusky Dolphins in North Patagonia, Argentina. *PLOS ONE, 10*(6) https://doi.org/10.1371/journal.pone.0126182

Research on the ecology of sympatric dolphins has increased worldwide in recent decades. However, many dolphin associations such as that between common dolphins (Delphinus delphis) and dusky dolphins (Lagenorhynchus obscurus) are poorly understood. The present study was conducted in the San MatIas Gulf (SMG) ecosystem (North Patagonia, Argentina) where a high diet overlap among both species was found. The main objective of the present work was to explore the niche overlap of common and dusky dolphins in the habitat and temporal dimensions. The specific aims were (a) to evaluate the habitat use strategies of both species through a comparison of their group attributes (social composition, size and activity), and (b) to evaluate their habitat preferences and habitat overlap through Environmental Niche modeling considering two oceanographic seasons. To accomplish these aims, we used a historic database of opportunistic and systematic records collected from 1983 to 2011. Common and dusky dolphins exhibited similar patterns of group size (from less than 10 to more than 100 individuals), activity (both species use the area to feed, nurse, and copulate), and composition (adults, juveniles, and mothers with calves were observed for both species). Also, both species were observed travelling and feeding in mixed-species groups. Specific overlap indices were higher for common dolphins than for dusky dolphins, but all indices were low, suggesting that they are mainly segregated in the habitat dimension. In the case of common dolphins, the best habitats were located in the northwest of the gulf far from the coast. In the warm season they prefer areas with temperate sea surface and in the cold season they prefer areas with relatively high variability of sea surface temperature. Meanwhile, dusky dolphins prefer areas with steep slopes close to the coast in the southwestern sector of the gulf in both seasons.

Crossman, C. A., Taylor, E. B., & Barrett-Lennard, L. G. (2016). Hybridization in the Cetacea: Widespread Occurrence and Associated Morphological, Behavioral, and Ecological Factors. *Ecology and Evolution, 6*(5), 1293-1303 https:/doi.org/10.1002/ece3.1913

Hybridization has been documented in a many different pairs of cetacean species both in captivity and in the wild. The widespread occurrence of hybridization indicates that postmating barriers to interbreeding are incomplete within the order Cetacea, and therefore raises questions about how species integrity is maintained in the face of interspecific (and often intergeneric) gene flow. We examined hybridization across the order Cetacea (oceanic species included: N = 78; species with 44 chromosomes included: N = 52) to test for associations between the occurrence of hybridization and similarity across 13 ecological, morphological and behavioral traits in hybridizing vs. non-hybridizing species pairs. We found that species pairs that share a greater number of traits had a higher propensity to hybridize than pairs of species that did not. This trend was driven by behavioral and morphological traits such as vocalization frequency and body size. Together our findings suggest the importance of divergent selection on morphological and behavioral traits within sympatric species in constraining

opportunities for hybridization and preventing the collapse of parental species.

Di Tullio, J. C., Gandra, T. B., Zerbini, A. N., & Secchi, E. R. (2016). Diversity and Distribution Patterns of Cetaceans in the Subtropical Southwestern Atlantic Outer Continental Shelf and Slope. *PLOS ONE, 11*(5), e0155841 https://doi.org/10.1371/journal.pone.0155841

Temporal and spatial patterns of cetacean diversity and distribution were investigated through eight ship-based surveys carried out during spring and autumn between 2009 and 2014 on the outer continental shelf (~150m) and slope (1500m) off southeastern and southern Brazil (~23°S to ~34°S). The survey area was divided into southeast and south areas according to their oceanographic characteristics. Twenty-one species were observed in 503 sightings. The overall number of species was similar between the two areas, though it was higher in the spring in the south area. Five species were dominant and diversity varied more seasonally than spatially. ANOVA and kernel analyses showed that overall cetacean densities were higher in spring compared to autumn. Physeter macrocephalus, the most frequent species, concentrated throughout the south area at depths over 1000m in both seasons. Despite the overlapped occurrence at a broader scale, small delphinids presented latitudinal and in-offshore gradients as well as seasonal variation in distribution patterns, which could indicate habitat partitioning between some species. Delphinus delphis was only recorded in the south and its density decreased in areas where the presence of Stenella frontalis increased, mainly beyond the 250m isobath. Densities of S. longirostris and S. attenuata increased in lower latitudes and beyond the shelf break. The large delphinids Tursiops truncatus and Globicephala melas formed mixed groups in many occasions and were observed along the study area around depths of 500m. Grampus griseus was twice as frequent in the south area and densities increased in waters deeper than 600m. As expected, densities of both small and large migratory whales were higher during spring, over the continental slope, in the southeast area. The results presented here provided strong evidence on the importance of the outer continental shelf and slope to a diverse community of cetaceans occurring in the subtropical Southwestern Atlantic.

Elliser, C. R., & Herzing, D. L. (2016). Changes in Interspecies Association Patterns of Atlantic Bottlenose Dolphins, Tursiops truncatus, and Atlantic Spotted Dolphins, Stenella frontalis, after Demographic Changes Related to Environmental Disturbance. *Marine Mammal Science, 32*(2), 602-618 https://doi.org/10.1111/mms.12289

Animal populations can be affected by environmental disturbances in many ways including demographic and behavioral changes. This can affect interspecies associations for regularly interacting sympatric species, like bottlenose and spotted dolphins in the Bahamas (observed since 1985 and interspecies associations analyzed since 1993). After two hurricanes in 2004 each species lost roughly 30% of their respective communities resulting in differing social structure and behavioral changes. During mixed species encounters (MSE) group sizes for spotted dolphins (= 14.1 ± 9.2) were significantly larger than bottlenose dolphins (= 6.0 ± 7.3; F = 11.74, df = 1, P < 0.001), however, t-tests revealed no differences between aggressive vs. affiliative encounters. Sexual/aggressive behavior regularly seen previously was not observed posthurricanes and aggressive encounters were greatly reduced. Generally results were similar to prehurricane data including high resightings of spotted dolphins with male alliances prevalent (including new juvenile alliances seen only posthurricane), and individualized bottlenose participation with few male alliances. However temporal associations varied compared to prehurricane. Interspecies association and behavior patterns were altered and likely affected by the changes in intraspecies

association patterns following the hurricanes. However both species still participated in MSE, suggesting this is an important component of their ability to coexist as sympatric species.

Elliser, C. R., & Herzing, D. L. (2016). Long-Term Interspecies Association Patterns of Atlantic Bottlenose Dolphins, Tursiops truncatus, and Atlantic Spotted Dolphins, Stenella frontalis, in the Bahamas. *Marine Mammal Science, 32*(1), 38-56 https://doi.org/10.1111/mms.12242

With the exception of primates, detailed interspecies behavioral studies are rare in mammalian species and for cetaceans, most are anecdotal descriptions. This study is the first long-term study on interspecies associations of regularly interacting groups. In the Bahamas Atlantic bottlenose (Tursiops truncatus) and spotted dolphins (Stenella frontalis) regularly form mixed species encounters (MSE). Both species show strong site fidelity with high resighting rates. During MSE, the majority (>65%) of spotted dolphins (especially males) were continually resighted; however bottlenose dolphins had comparatively low resighting rates (<17%). During MSE group size was significantly larger for spotted dolphins (13.0 ±11.0) than bottlenose dolphins (4.8 ± 3.5) ($F = 93.803$, $df = 1$, $P < 0.001$). This difference was largest during aggressive encounters, due to the increased spotted dolphin group size (t-test, $t = 4.75$, $df = 184$, $P < 0.0001$), but no difference in bottlenose dolphin group size. Strong associations (greater than twice the community average) were primarily between male spotted dolphins. Male alliances were prevalent for spotted dolphins but rare for bottlenose dolphins. These species differences were also observed in lagged association rates. These results highlight the differences involved in alliance formation and function for regularly interacting sympatric species and reveal insights into possible ecological and social reasons for these group formations.

Hill, M. C., Oleson, E. M., Baumann-Pickering, S., Van Cise, A. M., Ligon, A. D., Bendlin, A. R., . . . Bradford, A. L. (2016). *Cetacean Monitoring in the Mariana Islands Range Complex, 2015*. https://doi.org/10.7289/V5H70CTG

"This report includes a summary of the most recent visual surveys that were conducted in the winter (February-March) and summer (August-September) of 2015, the movements of a false killer whale (Pseudorca crassidens) that were satellite tagged during the PIFSC Mariana Archipelago Cetacean Survey in May-June, 2015, the results of nuclear and mitochondrial analysis of short-finned pilot whale samples collected during small-boat surveys of the southernmost Mariana islands (2011-2014), and analysis of beaked whale occurrence long-term passive acoustic data set for 2014-15. Analyses of acoustic data for baleen whales are still underway and will be reported at a later time"--page 2, 1st paragraph.

Ilangakoon, A. D., & Alling, A. K. (2016). Cetacean Sightings, Mixed-Species Assemblages and the Easternmost Record of Indopacetus Pacificus from the Northern Indian Ocean. *Marine Biodiversity Records, 9* https://doi.org/10.1186/s41200-016-0097-3

A visual survey of cetaceans was carried out during a voyage from Singapore to Sri Lanka, through the Straits of Malacca, Andaman Sea and across the Bay of Bengal in the northern Indian Ocean in November/December 2012. Forty sightings of 11 cetacean species were recorded in 19 days of observation. Two mixed-species associations of interest were recorded. One of these contained four species of odontocetes in association with each other. The second group was of Indopacetus pacificus in

association with Globicephala macrorhynchus and this while being the easternmost live sighting of I. pacificus in the northern Indian Ocean is also the first such mixed group in the Bay of Bengal.

Koper, R. P., & Plon, S. (2016). Interspecific Interactions between Cetacean Species in Algoa Bay, South Africa. *Aquatic Mammals, 42*(4), 454 https://doi.org/10.1578/AM.42.4.2016.454

When individuals of different species meet in a nonpredatory context, a trade-off is made between the costs (i.e., competition for food) and benefits (i.e., reduced predation risk, energetic benefits, and benefits of alloparental behaviour) of group formation (Gygax, 2002). In general, nonpredatory interspecific interactions (hereafter referred to as interspecific interactions) are classified as either positive or negative for either party involved (i.e., mutualism and competition, respectively) or at least for one of the interacting species (i.e., commensalism and parasitism, respectively) (Krebs, 1985). Positive interactions often result in the formation of mixed-species groups, providing either social and foraging advantages or protection from predators for at least one of the species involved (Norris & Dohl, 1980; Stensland et al., 2003; Bearzi, 2006). Competition is often the result of an overlap in preferred resources and/or habitat between two or more species. Reports on interspecific interactions among cetacean species are numerous.

Ponnampalam, L. S. (2016). No Danger in Sight? An Observation of Sperm Whales (Physeter Macrocephalus) in Marguerite Formation Off Muscat, Sultanate of Oman. *Aquatic Mammals, 42*(2), 162-167 https://doi.org/10.1578/AM.42.2.2016.162

Whales have developed anti-predator strategies of varying sophistication (Lima & Dill, 1990; Ford & Reeves, 2008). An aspect of the complex behavioural ecology of sperm whales (Physeter macrocephalus) includes the "marguerite" formation, first described by Nishiwaki (1962) and observed by whalers off Peru (Caldwell et al., 1966). The marguerite formation involves a group of whales positioning themselves in a circle at the surface in a manner akin to the spokes of a wheel, with their heads together on the inside of the formation and their tails radiating outwards (Nishiwaki, 1962; Whitehead, 2002) or in reverse with their heads facing outwards (Arnbom et al, 1987). Sperm whales were the most frequently sighted cetacean species during a survey in the western tropical Indian Ocean in 1995, which included the coast of Muscat, Oman (Ballance & Pitman 1998).

Ramos, E. A., Castelblanco-Martínez, D. N., Niño-Torres, C. A., Jenko, K., & Gomez, N. A. (2016). A Review of the Aquatic Mammals of Belize. *Aquatic Mammals, 42*(4), 476-493 https://doi.org/10.1578/AM.42.4.2016.476

Characterizing species occurrence, abundance, and distribution is critical to the management of natural resources and the conservation of biodiversity. In the Western Caribbean, little information exists on the occurrence of aquatic mammals along the Mesoamerican Barrier Reef System and adjacent aquatic ecosystems. Herein, we present the first comprehensive review of aquatic mammals encountered in the marine and freshwater habitats of Belize. To determine which aquatic mammal species occur in Belizean waters, we conducted an extensive review of published and unpublished reports of aquatic mammals. We located 163 unique reports from museum and animal collections, journal articles, theses, news reports, conference proceedings, institutional reports, and verified accounts from personal observations. Our review confirms the presence of 17 aquatic mammal species in Belize: 15 cetaceans

(Megaptera novaeangliae, Balaenoptera physalus, Ziphius cavirostris, Physeter macrocephalus, Kogia breviceps, Orcinus orca, Pseudorca crassidens, Globicephala macrorhynchus, Peponocephala electra, Stenella attenuata, S. clymene, S. frontalis, S. longirostris, Steno bredanensis, and Tursiops truncatus), one sirenian (Trichechus manatus manatus), and one carnivore (Lontra longicaudis annectens). Our findings provide the most up-to-date list of aquatic mammal presence in Belize. Given the limited data points obtained for most identified species, we recommend that systematic studies be conducted to investigate the status of the variety of aquatic mammals in the region to effectively monitor populations and devise strategies to mitigate the negative impacts of anthropogenic activity and climate change-related ecosystem shifts.

Reader, S. M. (2016). Animal Social Learning: Associations and Adaptations. *F1000Research, 5* https://doi.org/10.12688/f1000research.7922.1

Social learning, learning from others, is a powerful process known to impact the success and survival of humans and non-human animals alike. Yet we understand little about the neurocognitive and other processes that underpin social learning. Social learning has often been assumed to involve specialized, derived cognitive processes that evolve and develop independently from other processes. However, this assumption is increasingly questioned, and evidence from a variety of organisms demonstrates that current, recent, and early life experience all predict the reliance on social information and thus can potentially explain variation in social learning as a result of experiential effects rather than evolved differences. General associative learning processes, rather than adaptive specializations, may underpin much social learning, as well as social learning strategies. Uncovering these distinctions is important to a variety of fields, for example by widening current views of the possible breadth and adaptive flexibility of social learning. Nonetheless, just like adaptationist evolutionary explanations, associationist explanations for social learning cannot be assumed, and empirical work is required to uncover the mechanisms involved and their impact on the efficacy of social learning. This work is being done, but more is needed. Current evidence suggests that much social learning may be based on 'ordinary' processes but with extraordinary consequences.

Bacon, C. E., Smultea, M. A., Fertl, D., Würsig, B., Burgess, E. A., & Hawks-Johnson, S. (2017). Mixed-Species Associations of Marine Mammals in the Southern California Bight, with Emphasis on Risso's Dolphins (Grampus Griseus). *Aquatic Mammals, 43*(2), 177-184 https://doi.org/10.1578/AM.43.2.2017.177

Mixed-species associations are temporary associations of individuals of two or more animal species involved in similar activities. Among marine mammals, mixed-species associations are relatively uncommon and appear to vary by such factors as region, season, prey availability, and behavioral state. While mixed-species associations occasionally are reported for marine mammals in portions of the Southern California Bight (SCB) (e.g., Santa Catalina Island, Shane, 1994; Santa Monica Bay, Bearzi, 2005b), little attention has been given to understanding the broader extent and context of these interactions within the larger SCB. Over a 6-y period, the authors conducted line-transect aerial surveys throughout much of the SCB and became interested in the mixed-species associations they observed. Herein, they examine the relative frequency of species and behaviors found in marine mammal mixed-species associations, and describe those involving Risso's dolphins (Grampus griseus) since it was the most common species among mixed-species associations. They review and compare their observations with other data on mixed-species associations of marine mammals from California waters

Goodale, E. B., Beauchamp, G., & Ruxton, G. D. (2017). *Mixed-Species Groups of Animals : Behavior, Community Structure, and Conservation*. London, United Kingdom: Academic Press is an imprint of Elsevier. Retrieved from https://www.sciencedirect.com/book/9780128053553/mixed-species-groups-of-animals

Mixed-Species Groups of Animals: Behavior, Community Structure, and Conservation presents a comprehensive discussion on the mixed-species groups of animals, a spectacular and accessible example of the complexity of species interactions. They are found in a wide range of animals, including invertebrates, fish, mammals and birds, and in different habitats, both terrestrial and aquatic, throughout the world. While there are more than 500 articles on this subject scattered in separate categories of journals, there has yet to be a general, cross-taxa book-length introduction to this subject that summarizes the behavior and community structure of these groups. The authors first survey the diversity of spatial associations among animals and then concentrate on moving groups. They review the major classes of theories that have been developed to explain their presence, particularly in how groups increase foraging efficiency and decrease predation. Finally, they explore the intricacies of species interactions, such as communication, that explain species roles in groups and discuss what implications these social systems have for conservation.

Antoniou, A., Frantzis, A., Alexiadou, P., Paschou, N., & Poulakakis, N. (2018). Evidence of Introgressive Hybridization between Stenella coeruleoalba and Delphinus delphis in the Greek Seas. *Molecular Phylogenetics and Evolution, 129*, 325-337 https://doi.org/10.1016/j.ympev.2018.09.007

Natural interspecific hybridization might be more important for the evolutionary history and speciation of animals than previously thought, considering several demographic and life history traits as well as habitat disturbance as factors that promote it. In this aspect, cetaceans comprise an interesting case in which the occurrence of sympatric species in mixed associations provides excellent opportunities for interspecific sexual interaction and the potential for hybridization. Here, we present evidence of natural hybridization for two cetacean species commonly occurring in the Greek Seas (Stenella coeruleoalba and De/phinus de/phis), which naturally overlap in the Gulf of Corinth by analyzing highly resolving microsatellite DNA markers and mitochondrial DNA sequences in skin samples from 45 individuals of S. coeruleoalba, 12 D. delphis and three intermediate morphs. Employing several phylogenetic and population genetic approaches, we found 15 individuals that are potential hybrids including the three intermediate morphs, verifying the occurrence of natural hybridization between species of different genera. Their hybrids are fertile and able to reproduce not only with the other hybrids but also with each of the two-parental species. However, current evidence does not allow firm conclusions whether hybridization might constitute a step towards the generation of a new species and/or the swan song of an already existing species (Le., D. delphis). Given that the focal species form mixed pods in several areas of Mediterranean, this study is an excellent opportunity to understand the mechanisms leading to hybridization in the context of gene flow and urges for the evaluation of the genetic status of common dolphins in the Mediterranean.

Bittau, L., Leone, M., Gannier, A., Gannier, A., & Manconi, R. (2018). Two Live Sightings of Sowerby's Beaked Whale (Mesoplodon Bidens) from the Western Mediterranean (Tyrrhenian Sea). *Journal*

of the Marine Biological Association of the United Kingdom, 98(5), 1003-1009 https://doi.org/10.1017/s0025315416001892

Sowerby's beaked whale (Mesoplodon bidens) was previously known in the Mediterranean Sea from a single live stranding of two individuals in the French Riviera. We report here on two live sightings in the western Mediterranean, central-western Tyrrhenian Sea off eastern Corsica (Montecristo Trough) and off eastern Sardinia (Caprera Canyon) in 2010 and 2012, respectively. In both cases single individuals, possibly the same individual, occurred within groups of Cuvier's beaked whales (Ziphius cavirostris) suggesting inter-specific interactions. Based on our close observations of mixed-species groups of Sowerby's and Cuvier's beaked whales, we hypothesize that some previous long-distance sightings of beaked whales in the Mediterranean may not be reliably attributed to Z. cavirostris. The present sightings and previous live stranding indicate that the western Mediterranean Sea is the easternmost marginal area of M. bidens within the North Atlantic geographic range. Notes on behaviour are also provided.

Halpin, L. R., Towers, J. R., & Ford, J. K. B. (2018). First Record of Common Bottlenose Dolphin (Tursiops truncatus) in Canadian Pacific Waters. *Marine Biodiversity Records, 11* https://doi.org/10.1186/s41200-018-0138-1

Background: Common bottlenose dolphins (Tursiops truncatus) are distributed globally in tropical and warm-temperate waters with coastal and offshore ecotypes known. In the eastern North Pacific Ocean, common bottlenose dolphins are typically found in offshore waters as far as 41° N and in coastal waters as far as 38° N. Despite considerable survey effort, the species has not been previously recorded in Canadian Pacific waters. Results: On 29 July 2017, a group of approximately 200 common bottlenose dolphins were observed together with approximately 70 false killer whales (Pseudorca crassidens) in waters of 16.5° C at 50° N during a pelagic seabird and marine mammal survey off the west coast of northern Vancouver Island, British Columbia, Canada. Conclusions: This sighting represents the only occurrence of common bottlenose dolphins recorded in Canadian Pacific waters and, to our knowledge, is the most northerly record for this species in the eastern North Pacific. It is also the first sighting record of false killer whales in non-coastal waters in British Columbia, Canada. The occurrence of both species may be associated with a prolonged period of warming in offshore regions of the eastern North Pacific.

Weir, C. R., & Black, A. (2018). Records of the Dusky Dolphin (Lagenorhynchus obscurus) in the Falkland Islands, Including Associations with Peale's Dolphin (L. australis). *Marine Biodiversity Records, 11*(1), N.PAG-N.PAG https://doi.org/10.1186/s41200-018-0153-2

Background: The status of the dusky dolphin (Lagenorhynchus obscurus) around the Falkland Islands (south-west Atlantic) has been long debated, since most records published to date lack supporting information. There is also considerable scope for confusion with the sympatric Peale's dolphin (L. australis), which has a similar external appearance. Results: A literature review confirmed one previously-published record as dusky dolphin; a skull that apparently originated from the Falklands in 1955. Four new photographically-supported records of dusky dolphin are described, comprising three sightings and one live stranding. Two sightings consisted of the same dusky dolphin individual in a mixed-species association with Peale's dolphins in coastal waters. An additional sighting established their use of deep, offshore waters around the Falklands. Conclusion: The dusky dolphin is a confirmed component of the Falkland Islands cetacean community, but appears to be relatively uncommon. The

first documented occurrences of an association between dusky and Peale's dolphins emphasises the need for vigilance when identifying dolphins during cetacean surveys in the wider South American region.

Bonizzoni, S., Furey, N. B., Santostasi, N. L., Eddy, L., Valavanis, V. D., & Bearzi, G. (2019). Modelling Dolphin Distribution within an Important Marine Mammal Area in Greece to Support Spatial Management Planning. *Aquatic Conservation-Marine and Freshwater Ecosystems, 29*(10), 1665-1680 https://doi.org/10.1002/aqc.3148

Understanding marine mammal distributions is essential for conservation, as it can help identify critical habitat where management action can be taken. The semi-enclosed Gulf of Corinth, Greece, has been identified as an Important Marine Mammal Area by the International Union for Conservation of Nature (IUCN) Marine Mammal Protected Areas Task Force, based on the regular occurrence of odontocete populations. A 7-year (2011-17) dataset of boat-based surveys was used to model and predict the distribution of striped dolphins, Stenella coeruleoalba, common dolphins, Delphinus delphis, and common bottlenose dolphins, Tursiops truncatus, in the entire Gulf (2400 km(2)). Multiple geographic, bathymetric, oceanographic, and anthropogenic variables were incorporated in a combined generalized additive model and generalized estimation equation (GAM-GEE) framework to describe dolphin occurrence and produce distribution maps. Modelling indicated that striped and common dolphins prefer deep waters (>300 m) in the central and southern part of the Gulf, whereas bottlenose dolphins prefer shallow waters (<300 m) and areas close to fish farms along the northern-central shore. Model-based maps of the predicted distribution identified a preferred habitat encompassing most of the Gulf, also revealing: (i) hot spots of dolphin distribution covering about 40% of the Gulf's surface; (ii) an almost complete overlap of striped and common dolphin distribution, consistent with the hypothesis that common dolphins modified their habitat preferences to live in mixed species groups with striped dolphins; (iii) a clear partitioning of striped/common and bottlenose dolphin habitat; and (iv) the important role played by fish farms for bottlenose dolphins, consistent with studies conducted elsewhere in Greece. Evidence provided by this study calls for area-specific and species-specific management measures to mitigate anthropogenic impacts.

Eierman, L. E., Laccetti, K., Melillo-Sweeting, K., & Kaplan, J. D. (2019). Interspecies Pectoral Fin Contact between Bottlenose Dolphins and Atlantic Spotted Dolphins Off Bimini, the Bahamas. *Animal Behaviour, 157*, 167-176 https://doi.org/10.1016/j.anbehav.2019.09.002

Affiliative interspecies interactions are important to community structure within an ecosystem yet understudied relative to antagonistic relationships. Mixed-species associations provide important benefits via foraging, predator avoidance and social interactions. Tactile behaviours help with social bond formation and group establishment among conspecifics during social interactions, but little is known about the role of contact between heterospecific animals in mixed-species groups. Our objective was to quantify characteristics of pectoral fin contact between individuals of two sympatric species of wild dolphins, spotted dolphins, Stenella frontalis, and bottlenose dolphins, Tursiops truncatus, off Bimini, The Bahamas, in order to assess possible benefits of heterospecific interactions. Using underwater video recordings from mixed-species dolphin encounters from 2011 to 2017, we observed 74 pectoral fin contacts, of which 27 were between heterospecific animals. Encounters were either affiliative (61.5%) or sociosexual (38.5%). Conspecific and heterospecific dolphins had similar rates of initiating and receiving contacts. This suggests that during mixed-species groups, the cost-benefit trade-

off in choosing a social partner is similar for conspecific and heterospecific individuals. Heterospecific contacts initiated by S. frontalis were primarily affiliative whereas heterospecific contacts initiated by T. truncatus were sociosexual. Both sociosexual behaviour and pectoral fin contact in dolphins have been suggested as mechanisms of bond formation. We conclude that mixed-species interactions with pectoral fin contact may be a mechanism for social bond formation between heterospecifics and that these bonds may help to re-establish groups, as needed, for predator avoidance.

Espada, R., Olaya-Ponzone, L., Haasova, L., Martín, E., & García-Gómez, J. C. (2019). Hybridization in the Wild between Tursiops Truncatus (Montagu 1821) and Delphinus Delphis (Linnaeus 1758). *PLOS ONE, 14*(4), e0215020 https://doi.org/10.1371/journal.pone.0215020

A case of intergeneric hybridization in the wild between a female bottlenose dolphin (Tursiops truncatus) and a short-beaked common dolphin (Delphinus delphis), considered members of 'vulnerable' and 'endangered' subpopulations in the Mediterranean, respectively, by the International Union of Conservation of Nature is described in this paper. The birth of the hybrid was registered in the Bay of Algeciras (southern Spain) in August 2016, and the animal has been tracked on frequent trips aboard dolphin-watching platforms. This unique occurrence is the result of an apparent ongoing interaction (10 years) between a female bottlenose dolphin and common dolphins. The calf has a robust body with length similar to Tursiops, while its lateral striping and coloration are typical of Delphinus. It displays the common dolphin's 'criss-cross' pattern. However, the thoracic patch is lighter than in D. delphis and its dorsal area is light grey, with a 'V' shape under the dorsal fin. This paper also provides a comprehensive mini-review of hybridizations of T. truncatus with other species.

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Panicker, D., Sutaria, D., Kumar, A., & Stafford, K. M. (2020). Cetacean Distribution and Diversity in Lakshadweep Waters, India, Using a Platform of Opportunity: October 2015 to April 2016. *Aquatic Mammals, 46*(1), 80-92 https://doi.org/10.1578/am.46.1.2020.80

Prior stranding records suggest that at least 12 cetacean species occur within the Lakshadweep archipelago off the southwest coast of India. These islands consist of coral atolls and form the northern part of the undersea Chagos-Laccadive ridge. Distinct oceanographic features, seasonal monsoon cycles, and high productivity make this region a potentially rich cetacean habitat In this article, we report findings from the first systematic visual cetacean surveys, which were conducted from high-speed passenger ferries that sail between nine Lakshadweep islands. The surveys were carried out between October 2015 and April 2016 during both the northeast monsoon (October to December) and inter-monsoon (January to April) seasons. We used a line-transect survey framework to record sightings as well as group size estimates. We documented 139 sightings over 3,880 km of which 78 sightings were during systematic survey effort. Eight odontocete species were confirmed from these sightings: Stenella longirostris, S. attenuata, S. coeruleoalba, Tursiops spp., Globicephala macrorhynchus, Pseudorca crassidens, Grampus griseus, and Feresa attenuata. One Balaenoptera sp. was also encountered during this survey. S. longirostris was sighted the most often (n = 22) followed by Tursiops spp. (n = 18) and G. macrorhynchus (n = 13). We documented significantly higher sightings in the northeast monsoon season compared to the intermonsoon season. Along ferry routes, cetacean species differed significantly from each other with respect to their associations with seafloor slope gradients and distances to nearest landmass. We encountered mixed species assemblages of G. macrorhynchus with Tursiops sp. and S.

attenuata with Tursiops sp. Given the confirmed high cetacean diversity and occurrence in this region, there is a need for in-depth, long-term studies on biogeography, ecology, and population status of cetaceans here.